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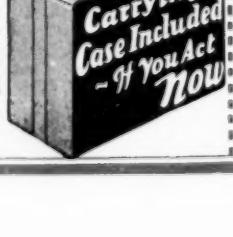

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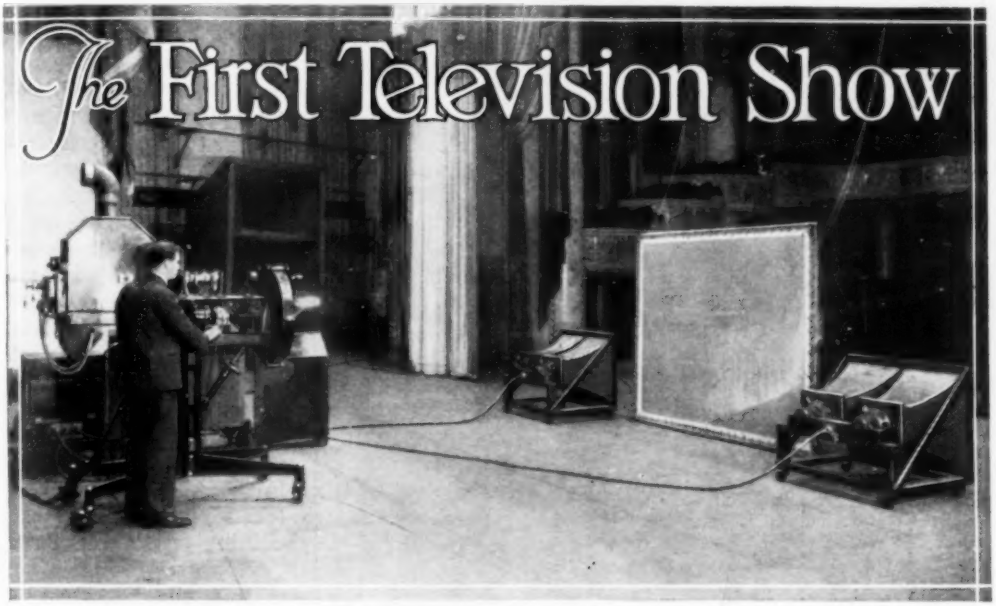
The First Television Show



R. D. Kell, Operating Television Theater Projector, Showing How the Picture Is Projected from Backstage; beside the Screen Are Loud Speakers for Reproducing Accompanying Radio Voice

A DARKENED theater, a curtain pulled back to reveal a screen, six feet high and seven feet long—forty-two square feet of silvery wall—and the world's first talking television show in a regular theater was on.

The projection apparatus was behind the screen and, not in the rear of the theater as with the movies. On the left side of the stage, a green spotlight shed its ghostly glow over an announcer standing beside a microphone. Then out of the dark boomed a voice:

"Is that you, Trainer?"

"Here we are!"

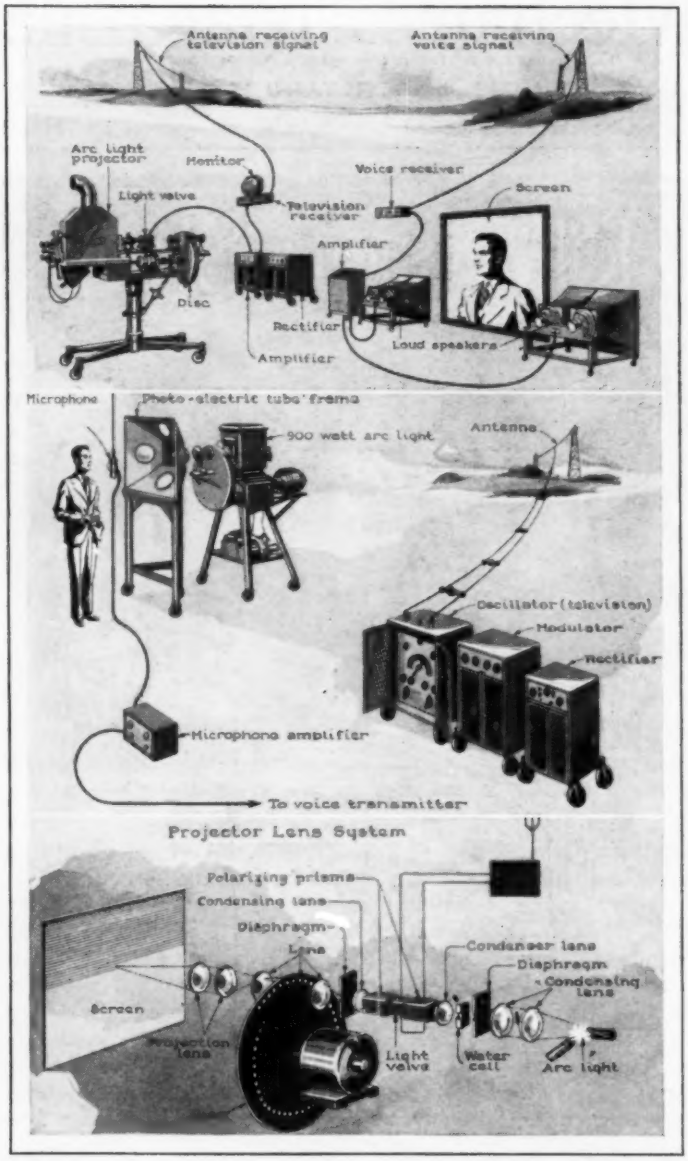
Merrill Trainer's moon face, wearing a broad grin, double its actual size, flashed on the screen.

"Let's see some smoke," commanded the stage announcer. "Light a cigaret!"

Trainer, who was more than a mile away, listening through a telephone, although his voice came back to us loud enough to be heard all over the 2,500-seat theater, was seen to light a cigaret and puff vigorously. A cloud of smoke filled the upper half of the screen.

As the master of ceremonies, Trainer then introduced several vaudeville teams and soloists. The team partners also were separated by the distance between the theater and the improvised laboratory studio. Yet they enjoyed an instantaneous exchange of thoughts, so that it was possible for them to sing synchronously, as if both stood on the stage before the audience.

The significance of television in the realm of entertainment became still clearer, when an orchestral leader, John Gamble, gave the title of four selections to his musicians in the orchestra pit. And lifting his baton, they saw him order the first chord of music. From the distant laboratory, Gamble conducted his men with no more difficulty than if he had been in the theater. The crucial test of his conducting and the synchronism of Dr. E. F. W. Alexanderson's apparatus came when the orchestra played a cuckoo



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song. Gamble alternated with the drummer and pianist in blowing out notes such as cuckoos sing.

Save for one slight interruption, the program continued for over an hour. The audience heard and saw mezzosopranos, comedians, monologists, as well as Gamble and Trainer. Everybody lost interest in the mechanics of television; the realism was convincing enough to make them forget they were entertained by wavelengths and lenses. What the showman calls "emotive force" came out into the theater. Those who sat before the television screen were moved by the symbols of laughter and pathos.

Brought to the finale, audience and spectators were escorted backstage. The television projector is a vivid arc light inclosed in metal. As it comes out of the illuminating chamber, the beam of light is condensed to a pencil's diameter. It passes through a tiny aperture in the diaphragm, then through a water cell. Now it reaches the vital stage in the Alexanderson system of television. After coming out of the water cell and polarizing prisms, the beam meets a wonderful device—invented by Dr. August Karolus, of Leipzig, Germany—popularly called a "light valve."

The Karolus cell makes life-size television possible. It has the ability to turn an intense beam of light on and off at high speed. Another explanation describes the cell as a flask filled with nitrobenzol, which literally twists a beam of light. In the Alexanderson system the Karolus valve displaces the neon tube, used in other systems of television. Its role in television is similar to the loud speaker's in radio receiving.

The subject to be "televized" stands before a rectangular opening, each side of which has a photo-electric cell. On the outside of the studio wall stands a four-legged apparatus supporting a scanning disk, about the size of a bicycle wheel, a

synchronized motor and an arc light incased in metal. This scanning disk, unlike the one at the theater, does not contain lenses in its forty-eight apertures. The openings are just plain holes and the disk rotates at a speed which allows 40,000 apertures to pass before the lamp beam in one minute.

From where he stands, the subject sees a flickering light coming through a two-inch aperture. At most, the illumination falling on the subject is very dim. In fact, he is plunged into almost complete darkness. But since no actor likes to perform under such conditions, Doctor Alexanderson was faced by a real problem until he devised a method of illuminating the tiny studio, the use of dull blue incandescent lamps making it possible to increase the illumination. Since blue neutralizes the orange gelatin covering the photo cells, the vital pulsations suffer no interference.

Several broadcasters are now sending out television signals, and they are being received hundreds of miles away. But they are merely silhouettes a few inches high. Attempts to broadcast halftone images over long distances are still unsuccessful, according to Doctor Alexanderson. It is difficult enough to send a television "still," but if moving figures are attempted, the reception is blurred. Without making absolute predictions, he does, however, hold forth hope.

The General Electric laboratories are in constant communication with the short-wave station VK2ME, at Sydney, Australia. Recently, a world's record for television reception was established when the Schenectady short-wave station transmitted a black rectangular design on a white postcard. Almost instantaneously, the design was rebroadcast by VK2ME on a wavelength of 28.8 meters and received in Schenectady, the complete circuit requiring about one-fourth second.

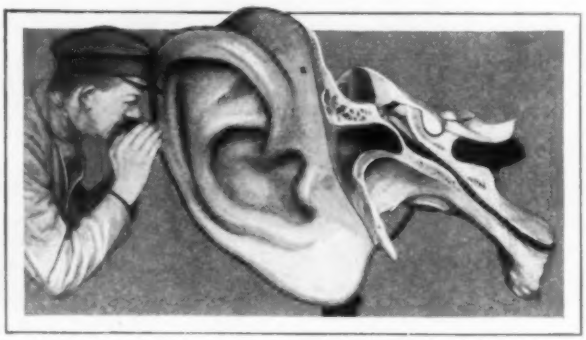
Demonstrating Automatic Baking Machine That Cooks Three Pancakes a Minute

AUTOMATIC FLAPJACK COOKER BAKES THREE A MINUTE

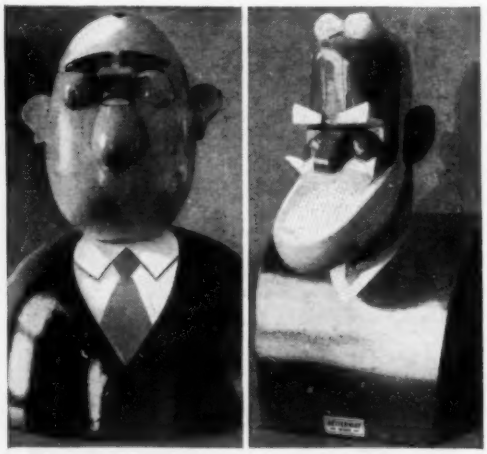
Turning out flapjacks or hot cakes at the rate of three a minute, an automatic pancake-baking machine does everything but serve the finished product. The big griddle, shaped like a huge hourglass, pours out the batter, bakes one side and turns the cake to complete the baking. It is intended for use particularly in restaurants and hotels.

BIG WAX MODEL OF HUMAN EAR IN HYGIENE MUSEUM

One of the interesting exhibits in the recently opened German hygiene museum in Dresden is a huge model of the human ear made of wax. The model shows every organ involved in the sense of hearing, making it easy to understand how sound waves reach the brain.



Model of Human Ear Compared with Size of Man's Head



Wood Caricatures of Paul Whiteman and George Bernard Shaw Show Novel Technique of Austrian Artist

CARICATURES IN WOOD SHOW SKILL OF ARTIST

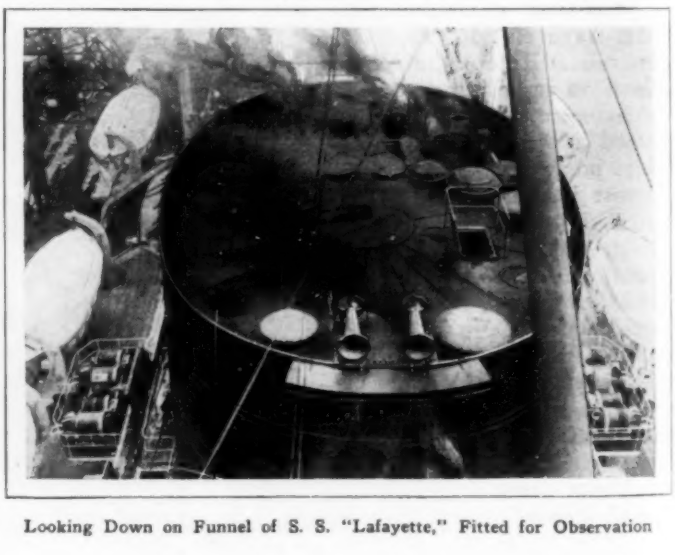
Caricatures of famous persons are presented in wood by a craftsman in Vienna, Austria, who carves and paints his figures in a distinctive manner. The accompanying busts of George Bernard Shaw and Paul Whiteman illustrate the character of his work.

JARS OF WALKING ARE GUIDE TO AUTO COMFORT

Automotive engineers have found that a rate of vibration of about ninety a minute, the same as the number of steps a man takes in the same time while walking at normal strides three miles an hour, is the most comfortable for the springing system of the average car. A slower rate may produce a feeling of seasickness, while faster action seems harsh. Many factors enter into the spring adjustments, but some of the chief principles involved are apparent in flipping a common table knife when the blade is held firmly, flat on the table, and the handle bent down and released. The periodicity of the vibrations can be changed by adding a weight to the handle or by lengthening or shortening the projecting part of the instrument. This shows why a car with longer wheelbase will have a less angular deflection when passing over a given bump. In the usual car with semielliptic springs, those at the front are usually much stiffer than those at the rear, because flexible front springs would make steering more difficult, and the rear springing is more important than the front because the passengers usually occupy the rear half of the car. The disadvantage of this is that a car so adjusted usually pivots at a point well toward the dash or even ahead of it, thus causing greater bounce in the rear seat. Properly adjusted shock absorbers, which should act as dampers without interfering with the flexibility of the springs, can be installed to counteract much of the unpleasant bounce in the back seat.

STAIRWAY IN LINER'S FUNNEL LEADS TO LOOKOUT

While modern motor-driven liners do not require funnels, smokestacks are still built into the vessels because it has been found that passengers expect them. On oil and coal-burning ships, "dummy" stacks are sometimes used to serve other purposes. One funnel on the S. S. "Lafayette," new transatlantic liner, has a plat-



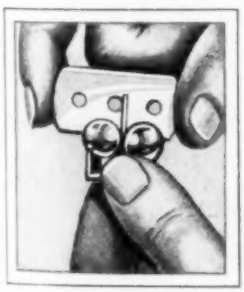
Looking Down on Funnel of S. S. "Lafayette," Fitted for Observation

form inside it a few feet from the top and an inside stairway leading to the funnel mouth, where passengers gain a view of the vessel and surrounding sea. Several ventilator openings also are located in the top of the big smokestack as well as a siren which can be used for sounding warning signals.

USEFUL CHEMICALS FROM WATER IN OIL WELLS

Salt-water waste that heretofore has interfered with oil drilling operations and polluted streams, is being salvaged for the valuable chemicals it contains at one of the Oklahoma fields. Sodium, calcium and magnesium chlorides are among the chemicals obtained, the treatment and reclamation processes being simple and inexpensive. From a barrel of salt water more than 100 pounds of solids are extracted, much of it iodine.

ROLLER SHARPENER FOR RAZORS FITS ALL BLADES



Safety-razor blades of all kinds as well as old-style blades are given keen edges in a sharpener with metal balls between which the blade is slipped and drawn back and forth to produce an effective edge. The unit occupies but little space, is always ready for service and requires no skill to operate.

¶Patent papers today simply bear a facsimile signature of the commissioner of patents, but, early in the last century, every one was individually signed by both the president and the secretary of state.

Fighting a Riot with the Armored Tank That Shoots Powerful Streams of Water Instead of Bullets

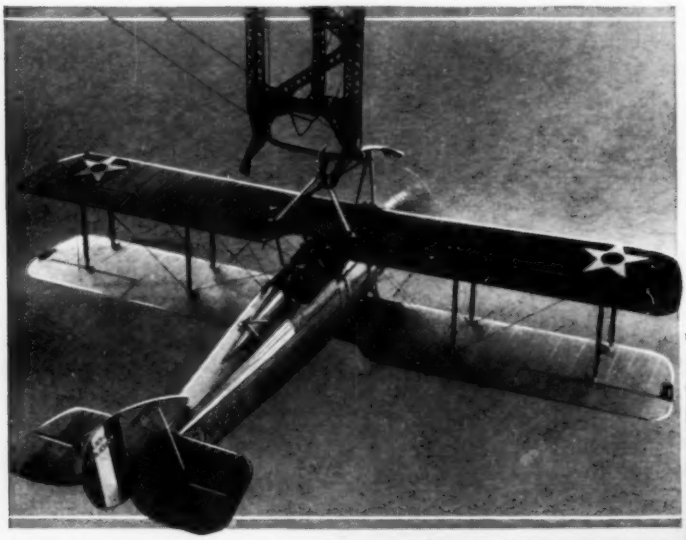
ANTI-RIOT CAR SHOOTS WATER FROM ARMORED TANK

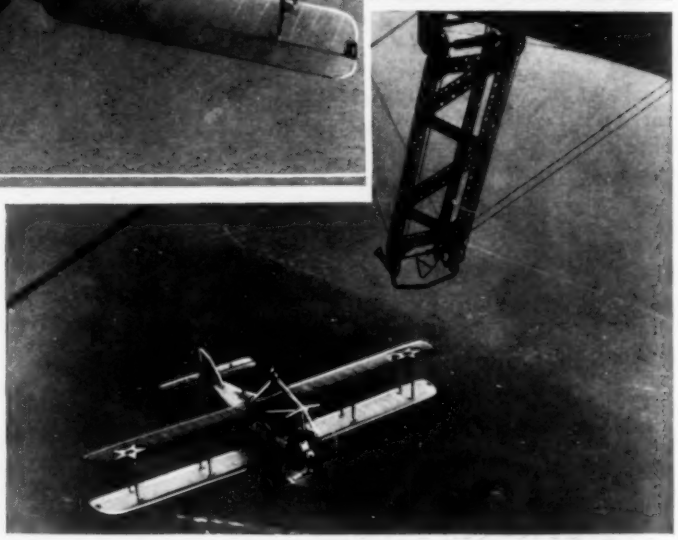
Berlin's police department has been equipped with a number of anti-riot automobiles to dispel unruly crowds. The car is an armored water tank on wheels capable of shooting water at tremendous pressure. Each car has a capacity of fifty-six gallons and the turret, resembling that on war tanks, is so arranged that water can be thrown in any direction.

BOTTLE CAPPER ALSO SERVES AS CONTAINER OPENER

Sealing bottles perfectly with a simple downward motion of a lever, a small and compact bottle capper now is available that is extremely simple to operate. A cap is inserted at the top and the lever is pressed down to seal standard bottles of any size or height. It is claimed not to break bottle tops and, as an added convenience, the lever can be used as a bottle opener.

PLANE HITCHED TO DIRIGIBLE BY HOOK IN FLIGHT





Navy Biplane Connecting with the "Los Angeles" in Flight

Mooring an airplane to a dirigible while both craft are in flight was again successfully accomplished recently when a navy biplane was hitched to the "Los Angeles," flying over Lakehurst. The airship is equipped with an adjustable hook or mooring bar on a hinged steel frame which is lowered from the underside of the big bag. Pilots of the plane have to exercise great care in making the contact, for a false maneuver would result in serious damage to the plane or its propeller, or to the dirigible.

HEAT RADIATED BY EARTH NEW WEATHER GAUGE

What the weather is likely to be may be accurately told a year in advance through measuring the amount of heat radiated by the earth, a scientific feat now being accomplished for the first time in history. For many years, it has been possible to gauge the amount of heat radiated by the sun, but the other factor, one considered highly important as affecting weather changes—the amount of heat that the earth sends back—has been largely a matter of guesswork. In this latest activity of science, the airplane is playing an important part, as it has in other fields of research. On cloudy days, army pilots take off from Bolling field, under the supervision of meteorologists from the weather bureau, with an instrument attached to the side of the cockpit of their planes. It is a photometer, so adjusted that it records a comparison of reflection between the sky illumination and the ground reflection. Cloudy days are chosen for the work because, under such conditions, the radiation from the sun is more nearly excluded and it is possible to determine more accurately the amount of heat being given off by the earth. The airplane permits these measurements at different altitudes and over a wide area. Another instrument being used for the radiation research is one that measures the amount of heat given off by the earth

at night when it is cooling off. Scientists believe that when they have an index as to the amount of radiation from the earth, they will be able more accurately to locate turbulent centers that give rise to storms and other weather conditions.

FLOWERPOTS ARE USED TO PRODUCE MUSIC

Musical flowerpots featured an exhibit of odd instruments made by Chicago school children recently. Hung upside down by wires from a rack, the pots, of different sizes and different thicknesses, produced melodious notes when tapped with padded hammers. Among the other articles displayed were Chinese chimes made from brass tubing cut into different lengths, a drum and tambourine prepared from sheepskin stretched over cheese boxes, an Egyptian harp made of half a metal cartwheel mounted on a wooden sounding box, and a Nubian sistrum, contrived from a coat hanger and metal washers.

Courtesy Chicago Daily News

Playing a Tune on Flowerpots; One of the Unusual Musical Instruments Made by School Children

Sand-and-Cement Model of Cathedral Which Contains Small Chimes Operated by a Keyboard

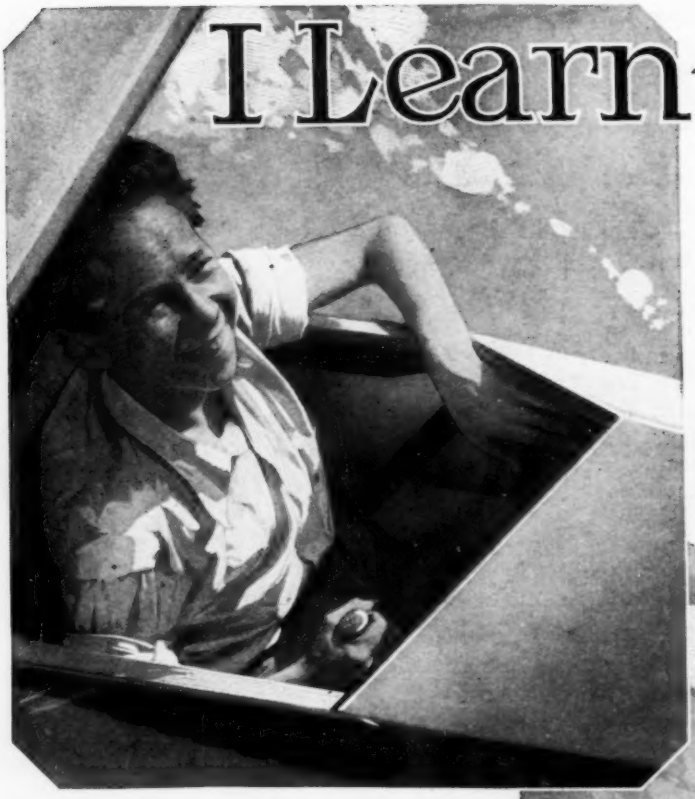
FIVE-FOOT CATHEDRAL MODEL OF CEMENT AND SAND

Constructed entirely of cement mixed with sand, a model of a cathedral, five feet and ten inches high and eight feet long, has been made by a student at Cambridge university in England. The central tower contains a peal of five bells which can be chimed by means of a keyboard, and another tower holds a clock that runs. One front is patterned after a cathedral in England.

DEMAND FOR COWBOY BOOTS KEEPS FIRM BUSY

From 15,000 to 18,000 pairs of cowboy boots are manufactured annually by a Kansas firm that keeps forty persons busy supplying the demand to cowboys, "dude" ranchers, stockmen and some farmers who prefer this style of footwear. A few are sold to circuses, rodeos and other exhibitions. Some patrons insist on elaborate boots and for them a special grade, costing $85 a pair, is provided.

I Learn to Fly



By BUD PERL

Note—The writer of this article, though only sixteen years old, is the holder of a glider pilot's license which he won with less than six months' training.

WHEN I started to learn how to fly a glider, the instructors put me at what they called "ground work." In this I learned how a primary glider is put together, what each part is made of, and why it stays up in the air. Then I was placed in the little seat of this elementary airship and taught to run it on the ground. Afterward, I flew a sailplane and obtained my license as a pilot.

As I look down from the cockpit of a sailplane, soaring 200 feet or more above the earth, I remember with a laugh the doubts which filled my mind the first time I sat in that training glider and grasped the stick in my hand. The primary training glider is far from the beautiful thing the sailplane is, for it consists mainly of a steel skeleton to which wings are fastened, and having out in front a shallow seat for the pupil. The rudder controls for the feet and the stick are the same, and in the same relative positions, while the low altitude to which this glider is allowed to rise takes all danger out of the first and most important part of training.

I took my seat in the

"All Ready," Shouts Bud Perl from Cockpit of Sailplane; Below, Perl Directing Wing Assembly

a Glider

frail chair out in front of the wing, put there for the express purpose of overcoming whatever fear may be in the mind of the pupil, and of giving him a more open point from which to steer than is provided in the cockpit of the sailplane. Lindbergh field, at San Diego, where I took these first lessons, offers a level surface some 3,000 feet long by 1,000 feet wide. The primary training glider, resting on the ground, with me in the seat, faced the wind, blowing in from the west, and the nose of the glider was connected by some 200 feet of half-inch rope with an automobile standing about that distance ahead of me.

I was told not to move the stick, which was in my right hand, but to steer—with my feet on the rudder bar—directly in the wake of the automobile. If I had pulled back on the stick, I would have gone into the air; if I had shoved it forward, I might have driven the nose down into the earth. So I held it in neutral, while the automobile rolled along down the field at twelve to fifteen miles an hour. The glider

Assembling the Sixty-Foot Wings, and the Glider Enthusiast Wearing New Sweater Which Goes with His License

Demonstrating Proper Position for Flight in Primary Training Glider; Steering Is Done with Feet through Rudder Controls

which remains on the ground all the time in these primary lessons, slipped a little to the right. I gave it the left rudder, that is, shoved out with my left foot, but pressed too hard, and, in a moment, I was slipping away to the left of the car. Then I turned it to the right and straightened out, only to go too far again, when I shoved back to the left, and by this time was swinging from side to side, "oscillating" as the pilots call it. I was overcontrolling, and the trail of the little rubber-tired wheels on the glider looked like a series of the letter "Z," rather irregularly drawn down the field.

On the second run, with a little more instruction from Hawley Bowlus, my teacher, I "dampened out" the tendency to overcontrol, and followed the automobile in a very nearly straight line for the full length of the field. When I came to the end of the tow, the men in the car lifted the tail of the glider, hooked it to the back of the automobile, and towed me backward to the starting point. Then I was shown how to use the control stick by moving it forward and backward and raising and lowering the tail, while being towed across the field. The wheels did not leave the ground as yet, but I worked at this until I was able to keep the tail in level flight position while running on the ground, and while guiding the glider with the foot rudder bar in a straight line behind the tow car.

When I had learned how to do all these things, regardless of the speed of the automobile, my instructors taught me lateral control, that is, the keeping of balance while running up and down the field, by moving the stick sideways. There I began to get the "feel" of balance, a

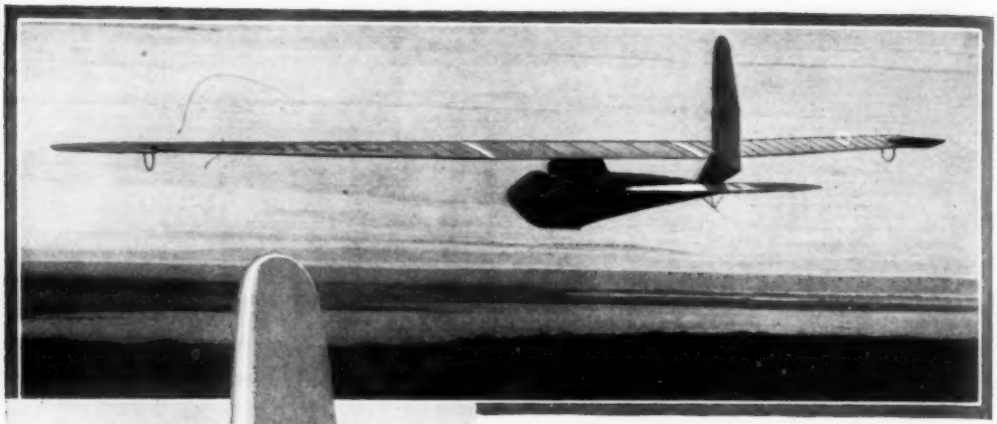
SO MANY requests have been received for plans from which to build gliders that Popular Mechanics wishes to call the attention of its readers to the advice of the National Glider association, which is: "Don't." A glider is an airplane in every sense of the word, less a motor, and only persons experienced in the construction of aircraft should attempt to build one. It takes as much skill to construct a glider as it does a motored plane, so it is best for beginners to purchase their equipment from a competent manufacturer.—The Editor.

Being Towed in a Primary Training Glider, and Sailing Smoothly Along; Note the Differences in These Two Gliders

feeling which becomes automatic as the pupil progresses in flying gliders. I imagine this is an essential to power-plane flying, and I know that I got it on the ground, by running the primary training glider across Lindbergh field until I could steer accurately, keep the tail up in flight position and maintain the even balance of the machine against the wind, even when towed in a curve.

With the fifth lesson, the length of the tow rope was increased, and the tow car driven somewhat faster. I found myself leaving the ground, and by working the controls and the stick as I had been taught, I was able to keep the glider on an even keel, flying, really flying, about four or five feet above the earth. When the car slowed, my first landing was bumpy, but in the third trial at towed flight, I was able to bring the "ship" down easily and slowly and trundle it to a stop, and even turn it about, with the nose in the right direction for the next tow.

When I had progressed sufficiently to keep the glider flying at forty or fifty feet above the ground, the driver of the tow car suddenly released the rope, when we were about three-quarters of the way down the field, leaving me to land without the confidential, though mainly imaginary, support of the tow line. I landed, kept the glider right side up, with the wings evenly balanced, made the turn and came up smiling from my first free flight. I felt literally "like a bird," and right there gliding assumed for me a far greater attraction as a sport than baseball, football, tennis or any other game I ever



Perl, in His Sailplane, Skimming Out over Mission Bay, and, Below, Assembling Huge Rudder

played. The further I have progressed in flying sailplanes, the stronger this feeling has become—that here is an individual sport which any healthy American boy can learn to play, which leads to a definite goal, the ability to fly a power plane, and meanwhile offers a fascinating pastime.

In order to fly the primary training glider, it is necessary that the pupil learn the handling of the controls, first on the ground and then in the air; second, that he or she acquire a sense of balance, the "feel of the air," along with co-ordination of eye and hand and foot, judgment of distance while moving on land or in the air; and, third, precision and quickness of motion, until what you might call "the flying habit" becomes almost involuntary. Some boys and girls acquire these qualifications more quickly than others, but it seems to me there is nothing to prevent any healthy boy or girl from learning to fly a glider correctly and safely.

MOUNTAINS CAUSED BY "PUFFS" FROM INSIDE EARTH?

That the mountains are the results of tremendous "puffs" of internal energy from the earth at intervals of millions of years, is the suggestion of Prof. A. C. Lane, head of the geology department of Tufts College. One way of checking on the idea would be to examine the supposed cycles of the puffing phenomenon to determine if they have about the length indicated, twenty-four million years, Professor Lane explains. It is possible to estimate roughly the age of mountain ranges. For instance, the Rockies and the Himalayas are younger systems, while

the Appalachians and the mountains around Lake Superior have been beveled off until they have been reduced to comparatively low altitudes. Scientists estimate that 15,000 feet of strata have been removed from the region of the Rockies and the Grand Canyon of the Colorado in the last two periods at a rate of approximately one foot in 3,000 years. This would make the length of the cycles from forty-five to sixty million years.

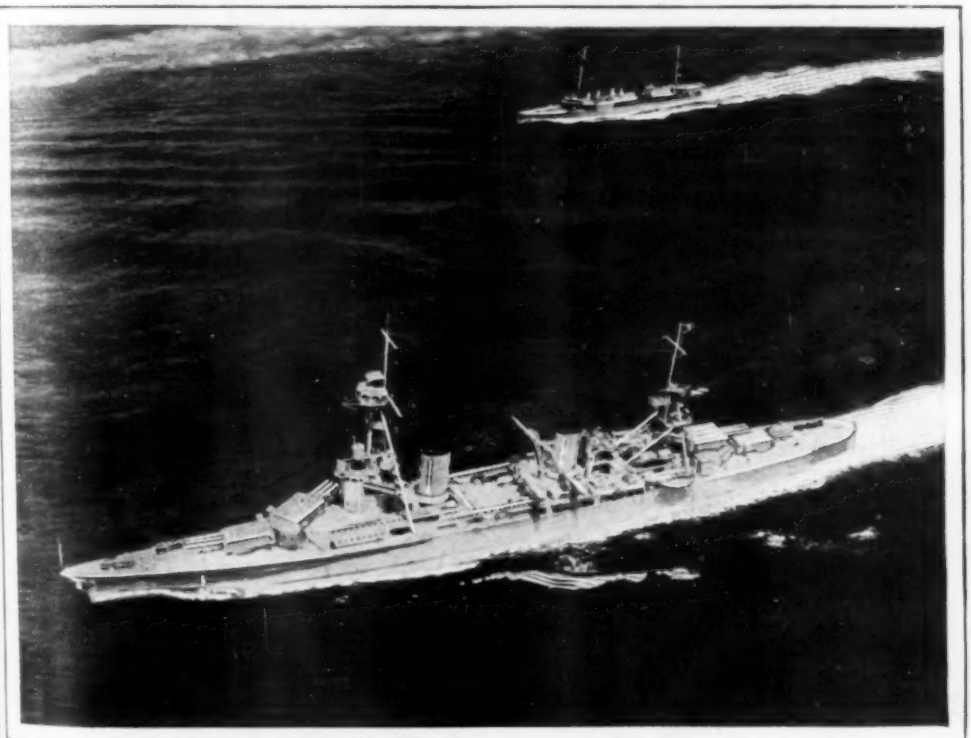
FASTEST CRUISER IN U. S. NAVY CARRIES AIRPLANE FLEET

The U. S. S. "Salt Lake City" is the latest and fastest addition to the United States navy, its powerful engines and trim lines affording exceptional speed. Besides the latest equipment of all kinds, the vessel is fitted to carry airplanes and launch them from the deck. Cruisers are generally less heavily armed than battleships but are faster and powerful in offense and defense. Some develop speeds of more than forty knots.

Adjustable Reading Lamp with Rack That Holds Books, Magazines and an Ash Tray

BRACKET READING LAMP HOLDS BOOK AND ASH TRAY

Particularly adapted for hospitals or for reading in bed, an adjustable reading lamp contains on its frame a combination book holder and ash tray. The lamp bracket can be extended to suit the eyes.



The "Salt Lake City," Fastest Cruiser in the United States Navy, Speeding Along under the Escort of the Destroyer "King"; Note Batteries of Guns and Vessel's Trim Lines

© C. W. R. Knight

Remarkable Photograph of Osprey Flying to Its Nest with Fish in Talons; Note Position of Bird's Wings for Landing

SECRETS OF EAGLES' FLIGHT REVEALED BY CAMERA

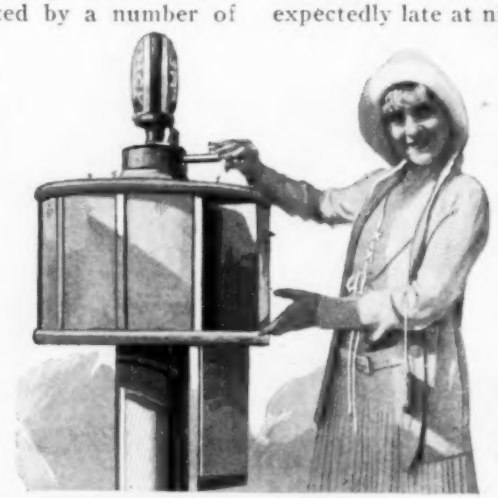
Motion pictures of eagles, ospreys and other birds in flight, taken by Capt. C. W. R. Knight, noted English naturalist, who has succeeded in taming eagles and teaching them to act as falcons, show many interesting things about the birds, their ways of flying and fighting. For instance, a large eagle, attacked by a number of ospreys, turned on its back while flying and with its powerful talons struck upward at the breasts of its enemies. The movements were clearly studied through the medium of slow-motion photography. Captain Knight's studies have also shown that the eagle, like the jackdaw, sometimes collects strange objects for its nest. An Italian peasant, working in a field, was surprised to see a beautifully bound book drop from the skies. He at first thought it had fallen from an airplane, but finally saw a large golden eagle flying over the spot where the book had fallen. The bird evidently had secured the book for the purpose of adding it to its nest.

SEAMLESS METAL TUBES ARE MADE ELECTRICALLY

A rapid process for manufacturing seamless tubing of copper, zinc or iron by electrolysis has been explained by Prof. Jean Billiter, of the University of Vienna. A lead core is run continuously through the solution and the metal is deposited on it as the core moves. Later, the lead core is melted away, leaving the deposit as a tube.

CAN OF GASOLINE IS DELIVERED BY AUTOMATIC VENDER

Motorists who run out of gasoline unexpectedly late at night when most filling stations are closed, save themselves a weary walk if they are near a gasoline automat which is making its appearance along the roadsides. The gas vender is operated on the coin-in-the-slot principle, and delivers a gallon of fuel in a can when a coin is inserted in the slot and the lever pressed.



Automatic Gasoline Vender Which Dispenses a Gallon Can of Fuel When Coin Is Dropped in Slot

¶ Box-car floors are being constructed of concrete.

INCREASE IN HERDS OF SEALS PERILS FISHING TRADE

Seals in the north Pacific have multiplied to such large numbers, due to protective legislation, that they have become a menace to the fishing industry in those waters, according to Japan, who asks that the restrictions against killing the seals be relaxed to such a degree as to effect a better balance. Diplomatic communications are being exchanged between the two governments in an effort to arrive at an understanding. The Japanese maintain that the seals have multiplied from about 132,000 in two decades until they now number nearly 1,000,000. They are voracious fish eaters, chase away many varieties and break the fishing nets, it is contended.

PICTURE OF WRITER ON CHECK PREVENTS FORGERIES

To prevent check forgeries, an Englishman has devised a protector in the form of a gummed stamp bearing a picture of the person who draws the check. When a check is signed, one of the adhesive stamps is affixed to it, and, under arrangements with a bank, only checks bearing both the signature and the picture of the signatory are honored.

Fixing Portrait Stamp to Check, to Identify It as Genuine and Foil Forgeries

Special Concrete Building Block, Showing the Smooth, Waterproof Surface, and Center Structure

LOW-COST CONCRETE BLOCKS ARE WEATHERPROOF

Concrete building blocks that are more economical than ordinary building materials, and may be laid much like brick, have been developed by a German engineer. The blocks are covered with a smooth weatherproof surface coating, and the development of the cheaper building units has helped stimulate construction in parts of Europe.

BATTERIES PLACED IN VACUUM HAVE GREATER CAPACITY

Storage batteries have about one-tenth more capacity when they are placed in a vacuum, a Japanese scientist reported recently. Under an atmospheric pressure of approximately two-tenths of a pound to the square inch, the capacity of a storage battery is increased about nine and two-tenths per cent, he declared. Atmospheric pressure is roughly between fourteen and fifteen pounds to the square inch. When restored to normal pressure, a battery will not return to its natural operation until it has been charged and discharged for an hour and a half, experiments revealed.

Applying Special Oil Colors to Photograph with Cotton-Wrapped Skewer Instead of Brush

OIL-COLOR TINTING OF PHOTOS REQUIRES NO BRUSHES

Transparent oil colors now are being used by both amateurs and professionals for the tinting of photographs, canvas miniatures and magazine pictures. No brushes or mixing of materials is necessary, the colors being applied with pieces of cotton wrapped about skewers.

OLD LOCOMOTIVE IS MONUMENT TO EARLY RAILROADERS

As a monument to early railroaders, an ancient locomotive stands in a bed of flowers near the Union depot in Portland, Oreg. It was placed there by the state, the engine claiming the distinction of being the first in the west. It was used by the government in 1862 on the bank of the Columbia river to carry freight above the rapids near Cascade.

Historic Locomotive Mounted in Bed of Flowers near Union Station at Portland, Oreg.

SKYSCRAPER WALLS OF METAL HERALD NEW BUILDING AGE

Sheet metal is being used largely to replace brick and stone in the construction of the walls of the new Empire State building in New York City, and in the innovation some engineers see the hastening of the day of the skyscraper of steel and glass and other materials. A silvery chrome-nickel-steel alloy in angular sections, one-twentieth of an inch thick, is to form a large part of the walls of the new building. This metal was first developed for gun linings. It does not rust or tarnish and is durable. The thin walls save space, cost less, reduce the weight and are said to enable the builders to make larger windows for the better health and enjoyment of the tenants. Glass, it is predicted, is to be used more extensively in the future for partitions and portions of outside walls. The Empire State building, being erected on the site of the old Waldorf-Astoria hotel, will have eighty-five floors and will rise to a height of 1,043 feet. The building itself will be topped by a 200-foot observation tower or mooring mast for airships, according to present plans. While engineers see few obstacles of a structural nature to the erection of buildings even higher than this, there are certain mechanical and economic factors that probably will limit the height of skyscrapers to altitudes not much greater than this. For instance, elevator cables have to be made large and heavy to pull the cars to these great heights, the speed of the elevators cannot be made excessive because of the harmful effect on the ears, and too much space has to be devoted to elevator shafts.

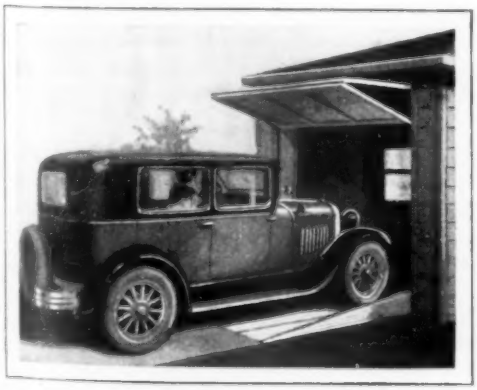
¶Approximately forty-three per cent of the families in the United States now own radio sets, according to a recent survey.

NEW TELEPRINTER SENDS CABLES DIRECT

Cablegrams as well as telegrams can be dispatched or sent direct from home or office on a teleprinter system being installed in England. The subscriber or renter of the automatic printer merely touches a switch to call the exchange, and when a signal is received types his message on the printer in the same manner as though using a typewriter. Incoming messages are received on the printer, thus saving the time for delivery.

THE CAR'S WEIGHT OPENS AND SHUTS GARAGE DOORS

Automatic garage doors, that open or close by the weight of the car upon a slightly elevated platform, have been introduced to save getting out of the car. The mechanism is installed inside the garage where it is not exposed to the weather, there is ample clearance on both sides, and the platform is so adjusted that it operates in spite of snow and ice.



Garage Door **Which Swings Upward Automatically When Car Is Driven on Inclined Platform**

German Weather Observers Gathering Data from an Airplane; the Camera Is Being Employed to Take Pictures of Cloud Formations

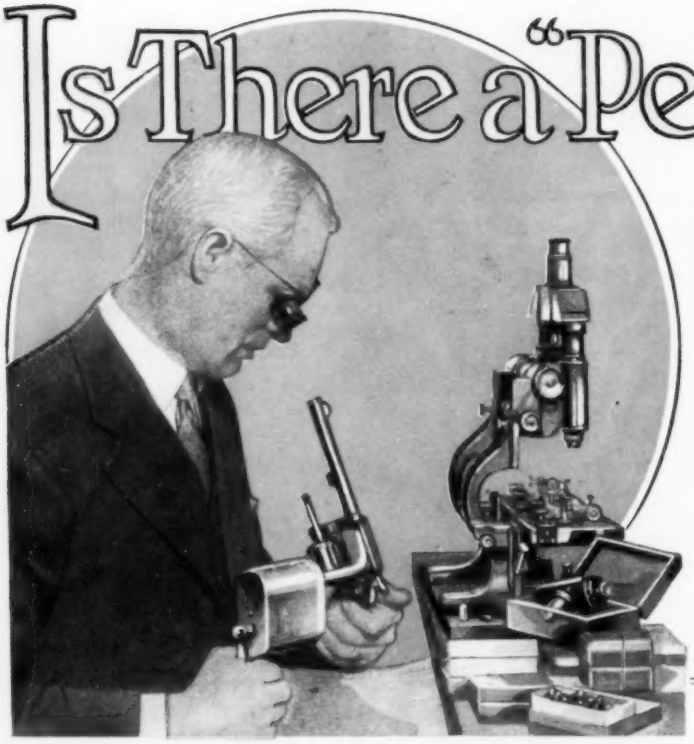
FLYING WEATHERMAN GATHERS DATA FROM AIRPLANE

German weather observers go aloft daily to gather data on atmospheric conditions. The pilot and observer ascend in a plane equipped with various recording instruments, and also use aerial cameras to take pictures of cloud formations.

OVER THOUSAND CROCODILES CARRIED BY TWO TRAINS

Sixty men worked for twenty-four hours recently to unload two special trains in France containing nothing but crocodiles. The shipment consisted of 1,085 live crocodiles destined for a French zoo, which is a sorting center and rest station for various animals being sent to circuses and other zoos.

Is There a "Perfect"



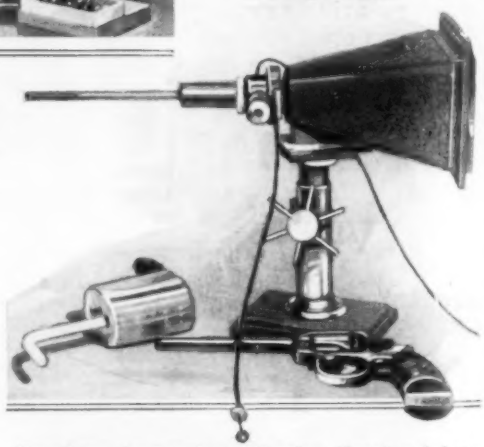
By JOHN F. COGGSWELL

IT IS well-nigh impossible to do murder by gunfire without leaving a host of clues, as clear as a printed page to the modern firearms expert. From the mortal bullet alone, he can tell the type and caliber of the weapon used, its maker and the maker of the projectile. His knowledge of the manner in which men fall when shot to death, combines with accurate measurement of the angle of penetration of the fatal bullet or bullets to reconstruct the crimes with a veracity that is the despair of slayers. The point of entry gives mute evidence of the distance between gun muzzle and victim.

"Here stood the victim and here the killer," he states, and usually he is correct in every detail as he sketches a word picture of the murder scene and points to the criminal. Let us consider an almost perfectly planned crime and watch the expert carry on to a successful conclusion.

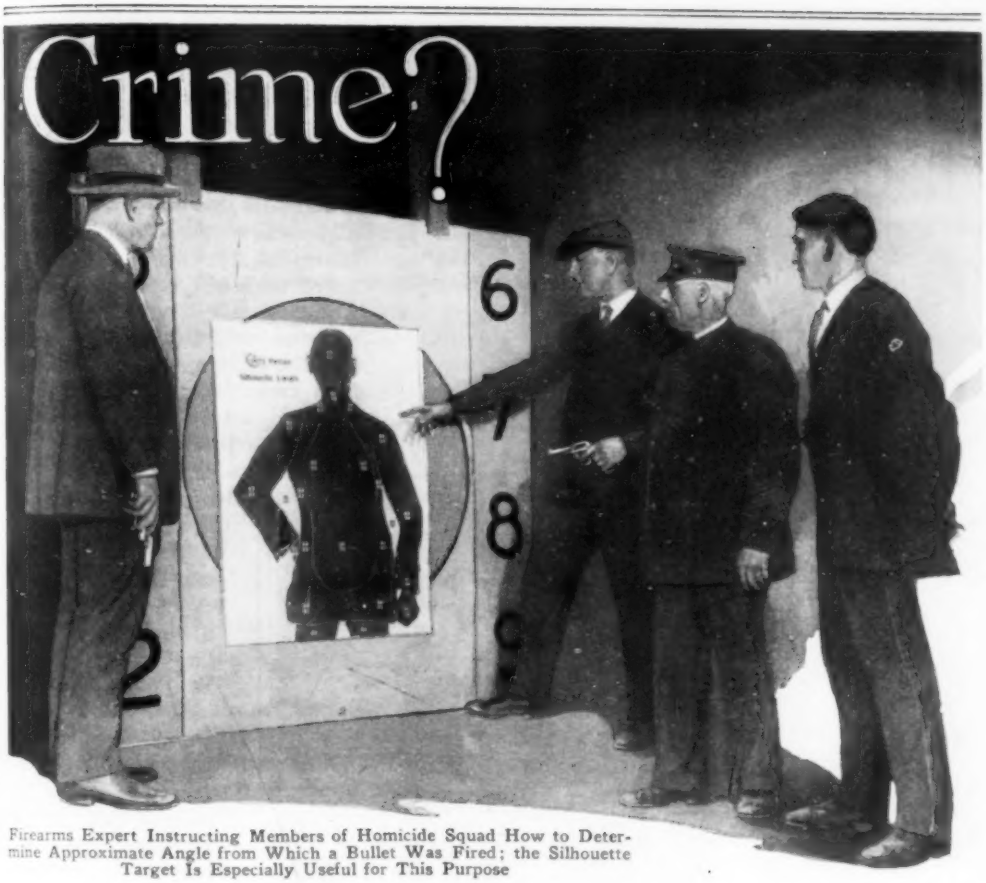
An old gentleman, with his son and his son-in-law, lived in a mansion on a lonely suburban estate. Behind the estate, in a wooded hollow, a cottage was occupied by a man of all work. On account of numerous trespasses, there had been much trouble between the workman and the occupants of the big house. Bad blood was especially strong between the laborer and the son-in-law.

One night the latter had gone into town to the theater. The father went to bed, leaving the son reading in the library, which was separated from the entry hall by a pair of heavy portieres. The old man had hardly fallen asleep when he was roused by the sound of a gunshot, running footsteps on the floor below, a slamming door and a muffled cry.



Examining the Interior of Revolver Barrel and Apparatus for Photographing Gun-Barrel Interiors

He shook himself awake, called out to his son, but received no response, and then made his cautious way downstairs. On the floor of the hall, close by the door, lay the huddled body of the son-in-law, flat on its face, a gaping wound in the



Firearms Expert Instructing Members of Homicide Squad How to Determine Approximate Angle from Which a Bullet Was Fired; the Silhouette Target Is Especially Useful for This Purpose

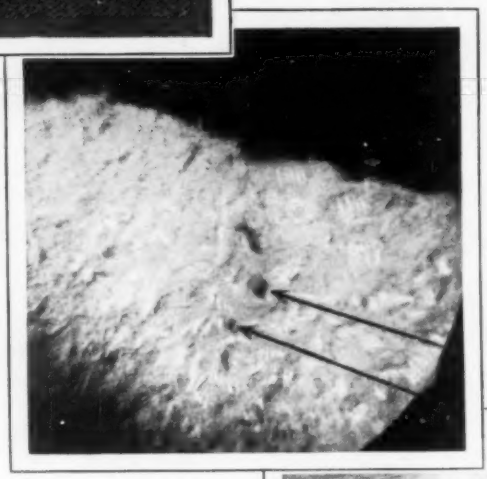
back of the head. As the old man stood frozen in horror, he heard moans and then a cry for help from the basement of the house.

Recognizing the voice, he rushed down the basement stairs and found his son lying in a pool of blood flowing from a half-dozen wounds—deep knife slashes they proved to be. The local police arrived on the scene within a few minutes, sent the son to the hospital and began their investigation.

The fatal bullet had hit the son-in-law squarely between the eyes, emerged through the back of the skull, at a slightly upward angle, and buried itself deep in the woodwork of the doorway. Such tremendous striking energy gave proof that the weapon used must have been a high-powered rifle.

Below an open basement window stood a barrel, bottom up. Beside it lay a blood-stained knife. As its ownership was not established and it proved barren of legible fingerprints, it did not become important evidence. The netting of a screen that covered the window had been slashed and turned back, so that a latch could be unhooked that had held it shut. Soot and dust on the sill had been brushed as though by the passage of a person through the opening.

The son stated that he had been reading in the library, awaiting the return of his brother-in-law. He heard the latter open the door, enter and close it. Then the shot crashed out. He jumped from his chair and, rushing into the hallway, saw a figure, dim in the half-light of the end of the passage, just disappearing through the door to the cellar stairs. He pursued the fugitive and grappled with him in the basement. However, he had been fought off and felled by a fierce at-



tack with a knife. The fleeing man had leaped to the barrel, dived through the open window and vanished into the night.

Search of the workman's premises revealed a .32-special rifle, hidden in the woodpile, a recently discharged shell in the barrel. He was arrested and charged with the crime. He admitted that the rifle was his but stoutly maintained his innocence. The gun, he claimed, must have been stolen during his absence from home, from its usual-place in a closet.

To the suburban police chief, it looked like an air-tight case against the workman. Motive, mode of entrance, opportunity and weapon were, seemingly, all present and accounted for. The evidence appeared good for a conviction before any jury. However, in order to cover all angles, the chief called into the case Capt. Charles VanAmburgh, ballistics expert, of the Massachusetts department of public safety.

At the morgue, the expert determined, by measurement, the distance above the floor of the points of entry and exit of the bullet and its path through the victim's head. That angle of fire, extended at the scene of the crime, proved that the bullet in the woodwork was likely the fatal one. Added and more gruesome proofs the bullet had carried along on its flight and deposited on the scarred trim.

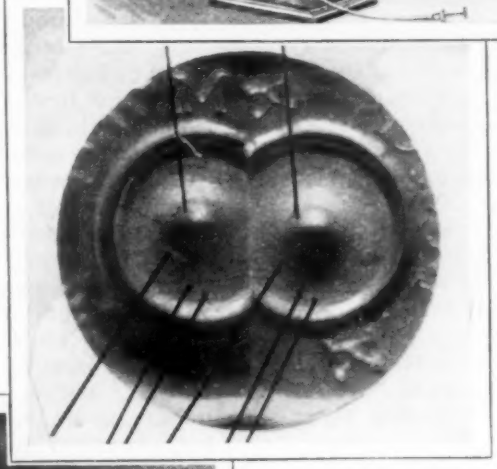
When the firearms expert examined the shattered woodwork, where the projectile had plowed an entry, he found a flaw in the son's story of the crime. Had the shot been fired from the rear of the hallway, the bullet would have gone nearly straight into the wood, after traversing the victim's skull. But it had crashed through a long section of the wood at an acute angle, and when that angle was laid out on the floor of the hall, it pointed straight to the opening between the portieres.

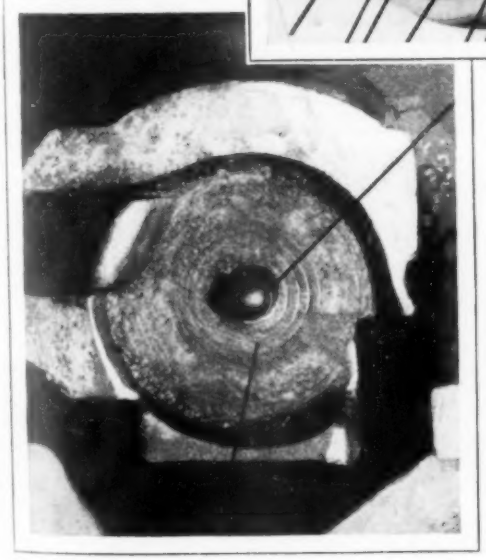
The expert, very carefully, removed every fragment of the projectile from the woodwork. While the metal jacket was split about four-fifths of its length and separated into three twisted portions, and the lead was

Three Shots through Fabric, Each Fired from Different Range; Two Murder Clues, and Lead Specks in Wallpaper and Plaster on the Bullet

knocked into bits, the rifling marks of the weapon were intact on the shank. Bullet and rifle were taken to the laboratory.

Here the process of determining the caliber and make of a discharged bullet and the type and make of gun that discharged it demands the technical training of an expert, but is perfectly comprehensible to the lay mind. The bullet in this particular case went through just about the entire process. Measurement of the intact shank proved it to be four-thousandths of an inch smaller than the usual .32-special projectile. That isn't much. The average human hair is three and one-half thousandths of an inch in diameter.





Top, Photographing Gun-Barrel Interior; Center, Two Test Shells Compared, and, Bottom, Gun Parts That Caused the Markings Above

The mortal bullet would have passed as .32-caliber to the expert's eye but not to his instruments of precision.

Weighing of the bullet gave but little information, as a portion of the lead had been lost in the victim's skull and in the woodwork. The battered projectile was mounted on a universal-movement stage beneath the lens of a powerful compound microscope, so that the number, width and depth of the impressions of the rifling lands and grooves might be established. These dimensions are different for each caliber, type and make of weapon.

An indispensable part of the modern firearms expert's equipment is a set of tables showing the complete details of all the several thousand different guns likely to be encountered. For each revolver, pistol or rifle, seven specifications are given: bore of barrel, depth of groove, rate of rifling twist, width of groove, number of grooves, width of land (the section between the rifling grooves) and the number of shots. Other tables give complete statistics of all calibers and makes of ammunition.

Most of the measurements are microscopic. In depth of groove there is but seven-thousandths of an inch between the deepest and the shallowest—twice the diameter of a single hair. Such a dimension is measured through a calibrated eyepiece, the measurements being read from a scaled dial on the focusing screw.

To establish the rate of twist, a photomicrograph, showing the bullet in mammoth proportions, is made. Certain measurements—the gift of Captain Van-Amburgh to the ballistics world—give the length of barrel in which the rifling makes one complete twist. Widths of lands and grooves present a variance up to nearly three-hundredths of an inch, a world of difference under the expert's microscope.

When the firearms authority had completed all these measurements of the bullet that had slain the murdered man, he found that they tallied with nothing described in his commonly used tables, let alone the .32-special, so that weapon was eliminated from the case. But one thing he had determined in examining the bullet put him on the right track. Its jacket was of soft steel instead of the usual copper alloy.

In spite of the prevailing impression, there has never been a steel-jacketed bullet manufactured in the United States, nor in most European countries. However, during the World War, Austria, short of copper, did jacket bullets with steel. In the table of arms and ammunition used by the central powers in the war, the expert found the weapon he was looking for. The mortal bullet had been fired from an eight-millimeter-caliber Austrian army rifle, he told the chief.

When questioned, the father remembered that the son had brought home from France, after the war, some sort of a foreign rifle as a souvenir. He was under the impression that it had been thrown or given away some months previously. But it hadn't been. A search revealed it, a recently discharged shell in the chamber, in a recess beneath the bottom drawer of a pantry close to the head of the basement stairway.

Then the expert gave his version of the crime. The murderer stole the workman's gun, discharged a shot from it and secreted it where it was found. On the night of the crime, he slit the basement screen and gave the opening perfect semblance of a forced entry. Then he took his stand behind the portieres to await the return of the son-in-law. He was armed with the war weapon, which he had taken from the recess where it had long lain awaiting an opportune time for the killing.

The doomed man entered the door and closed it behind him. A low voice called to him from behind the portieres and he turned to face it. Then the murderer pulled the trigger. In ninety-nine cases out of a hundred, the experts say, a person shot when looking directly into the gun muzzle, has been spoken to just before the fatal shot.

The Riot Squad Receives Instruction in the Use of a Machine Gun, So That They May Match the Proficiency of Some of the Gangster Crews in Handling This Weapon

The murder accomplished, the killer ran down the hallway, thrust the rifle back into the hiding place beneath the drawer and slammed the drawer in—the sound that the father had mistaken for the closing of a door. Then the son—for the son, as the reader has probably concluded, was the slayer—had rushed down the basement stairs, inflicted the knife wounds upon himself, tossed the knife to the place where it was found and called for help.

Faced with the expert's reconstruction of the crime and the gun he considered safely hidden away, the son admitted his guilt and corroborated the expert's word picture in every detail.

In fully seventy-five per cent of the criminal shootings in the United States, the bullet is found to have been fired from a .32 or .38-caliber revolver or automatic pistol. But keeping to these types affords no protection to the criminal. For no gun-barrel interior has ever been found so perfectly finished that it will not mark its projectiles in a manner that will enable the expert to bring bullet and gun together. Nor has a breech block ever been made so smooth that it will not leave impressions just as characteristic on the head of a shell kicked against it by the tremendous force of the exploding powder charge.

RADIO AIDS IN LAYING PIPELINE

Radio was called upon as an assistant to the engineer in charge of laying a pipeline across a lake in Germany. The working force was distributed over a large area, and as it was important that the lowering of the pipe should take place simultaneously along its entire length, a microphone was installed beside the engineer's leveling instrument and his orders were transmitted, first to a motor truck fitted with a receiving set and loud speaker of great amplifying power, and thence broadcast to the workmen.

Unusual Position Assumed by a Wrecked German Ship; She Is Standing on Her Beam Ends with Propellers and Rudder above Water

SHIP'S TRAGIC END IS SHOWN IN UNUSUAL PHOTO

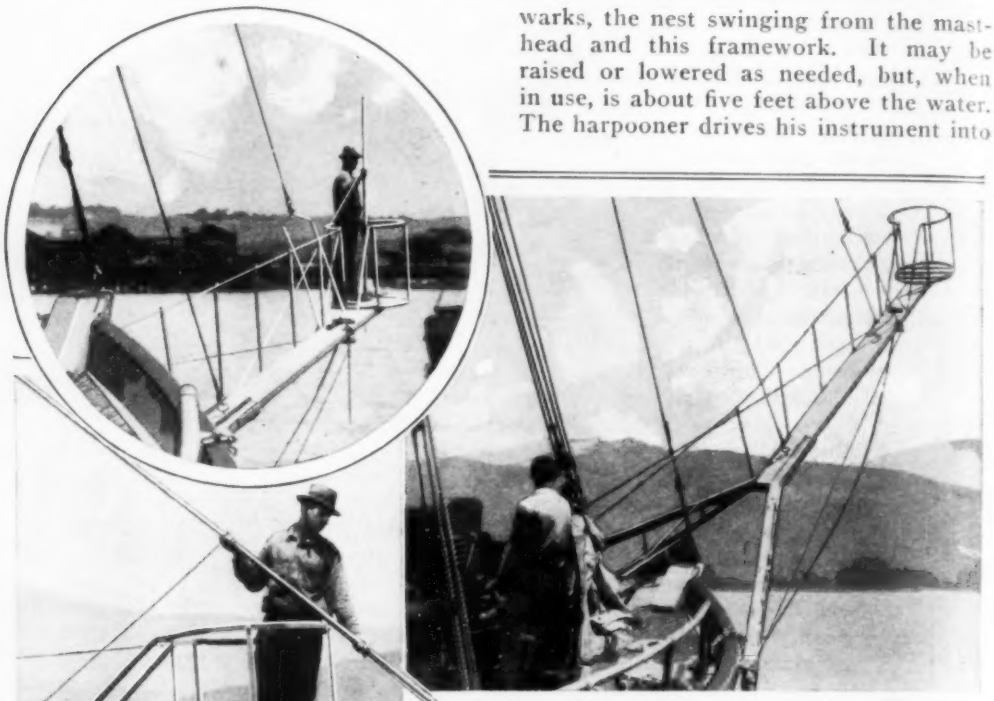
After a rock ripped a huge hole in her bow, the German steamer "Monte Cervantes" sank in the Beagle channel, off Ushuaia, Tierra del Fuego, and came to rest on her beam ends. The unusual position of the vessel was emphasized by the propellers and rudder which protruded above the water. The commander went down with the ship.

ELECTRIC AUTO AS CADDY SERVES CRIPPLED PLAYER

To assist a one-legged golf player, a small electric automobile that can be driven over the links without damaging the turf, was constructed. It attains a speed of eleven miles an hour and holds a number of clubs besides a passenger.

Crippled Golf Player, and the Electric Auto Which Carries Him and His Clubs over the Course

SPEARING SWORDFISH FROM A SWINGING "PULPIT"



Swinging "Pulpit," Extending from Forward Bulwarks of a Fishing Boat, on Which an Expert Harpooner Stands While Spearing Swordfish

From a swinging platform or "pulpit," extending thirty feet in front of the ship itself, fishermen of San Diego, Calif., harpoon swordfish as the motorship to which the pulpit is attached runs head-on into the school. The pulpit is a rigid steel framework fastened to the forward bulwarks, the nest swinging from the masthead and this framework. It may be raised or lowered as needed, but, when in use, is about five feet above the water. The harpooner drives his instrument into a swordfish by stabbing downward with a thirty-foot pole from his platform, the harpoon remaining in the fish while the pole is withdrawn. Nine hundred feet of rope are attached to the harpoon, and frequently a fish weighing from 400 to 1,000 pounds fights at the end of the line for an hour. The pulpit is hauled up with cable and engine when not in use.

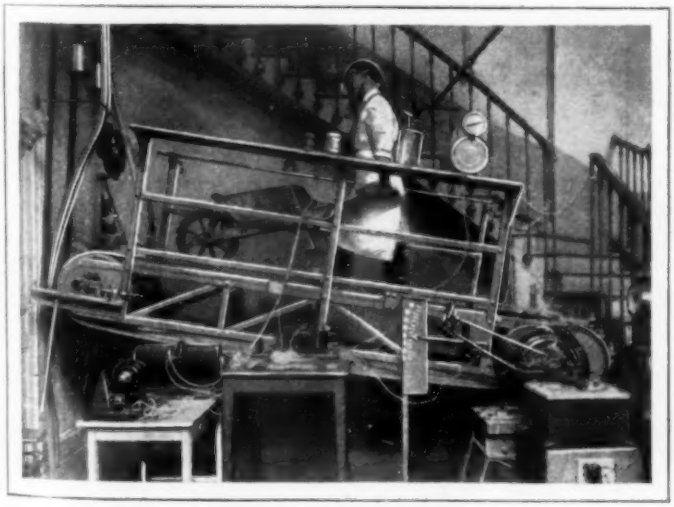
CRUDE OIL SEEN AS AUTO FUEL WITH DIESEL ENGINE

"Gasoline buggies" may be things of the past and crude oil the predominant fuel for automobiles, if development of the Diesel engine brings results now promised, in the opinion of engineers. During a recent test with an engine of this type, designed primarily for marine use, a sedan and a roadster were run an average of twenty-five miles to a gallon of six-cent crude oil for a total distance of 6,000 miles. The only marked difference as compared to the ordinary gasoline engine, was a little sluggishness on the pick-up from stop to twenty miles an hour. The top speed was fifty-five miles an hour. That was the record for the sedan. In the roadster, better accelera-

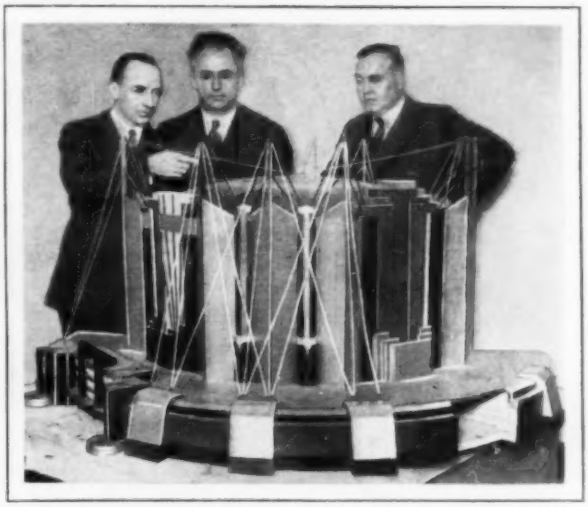
tion was obtained and a top speed of eighty-eight miles an hour was recorded. While the Diesel offers fuel economy and elimination of the usual ignition system, its original cost is still too high to make it entirely practical for wide adoption, and it is too heavy. However, engineers believe that further research and improvements will overcome these obstacles.

ENERGY OF WORKERS IS MEASURED BY TREADMILL

How much energy does a man expend while pushing a wheelbarrow up a hill? Science supplies the exact answer by means of interesting apparatus devised by a French professor, who has rigged a treadmill arrangement whereby accurate studies can be made of the physical reactions of persons to various tasks and their fitness for different kinds of work judged. Instruments connected to the subject and to the moving platform on which he walks, register the increase in temperature of the man's blood, its pressure, the fatigue experienced, and amount of energy put forth in doing this task. The apparatus tells the effects of walking, of running and of doing various kinds of work.



Treadmill Which Accurately Measures the Energy Expended by the Person Walking in It in Performing Various Kinds of Work



Scale Model of Section of a Building Supported by Specially Braced and Arranged Hooks Instead of Columns

"SKY HOOKS" TO SUPPORT ROOFS OF WORLD'S FAIR BUILDING

Among the unusual architectural features of the Chicago World's Fair Centennial celebration to be held in 1933, will be roofs supported by the so-called "sky-hook" method. Tops of the domes at either end of the huge Transportation building, according to present plans, will be constructed in this manner. Instead of being held up by interior columns and girders, the roof is largely supported by a system of "hooks" or specially braced and arranged members that hold the weight usually laid on columns or other units inside the building. This plan will afford an interior unobstructed by pillars, and the sky hooks will also harmonize with the unique appearance of the building itself, which is to be covered with a special metal on the outside and will have no windows, all the lighting being from within. The accompanying illustration shows a scale model of one section of the Transportation building and the sky-hook roof.

This Inventing

Courtesy Smithsonian Institution

Lieut. John Fitch's First Steamboat at Its Public Trial on the Delaware River at Philadelphia, July 27, 1786; from a Painting by Clyde O. DeLand

By DON GLASSMAN

AMERICAN invention stabilizes national wealth and gives health to every industry.

Day by day, come scraps of paper from inventors. Some show crude drawings; others employ poor English. It is the examiners' business to judge an inventor's creativeness, not his grammar. Has this thing been invented before? Is it a modification of another invention? Is it practical? The examiner searches. He searches long and late. In four cases out of seven, he awards the inventor with a certificate and admits him into the company of Marconi and Bell, Morse and Berliner, Edison and Goodyear.

Commissioner of Patents Thomas E. Robertson told me that he is unable to recognize a great invention before it has won a place in the world.

"I cannot, of course, express opinions on the merits of individual patents while they are in this office," he said, "but I am frequently upset in my estimate of what certain inventions are worth. Some patents that come here look very promising; but, at some later date, we may hear of their failure. Still others are so crude that they seem to have little promise; yet they may yield wealth and fame."

The chief of a division corroborated the commissioner. "I have been here fourteen years," he said, "and am still unable to pass judgment on the financial worth of an invention. I issued a patent to George Campbell Carson on a machine for feeding copper-smelter furnaces. It didn't look very unusual. It was all in a day's business. Well, recently we heard that Carson had recovered millions of dollars from smelting companies that had used his invention without his sanction. Originally, he had refused a paltry $3,000 for it, holding out for a royalty basis.

"Very often, the first news that an invention is successful comes to us through newspapers or popular magazines.

"Perhaps you never heard of an interlocking shingle. It helps to make a roof water-tight. A very simple invention. Yet that shingle pays the patent owners $400,000 in royalties every year.

Imagine a Transcontinental Train of Today Being Pulled across the Rockies by an Engine Such as This, Stephenson's "Rocket" That Ran during the Earliest Days of Railroading

"One of the latest improvements in steel construction is a process of welding girders by electricity. It eliminates rivets. A steel skeleton of welded girders is without joints, and the inventor claims that it is much stronger than a riveted structure. It can be used in bridges as well as building construction, and no doubt can be adapted to ship hulls, too.

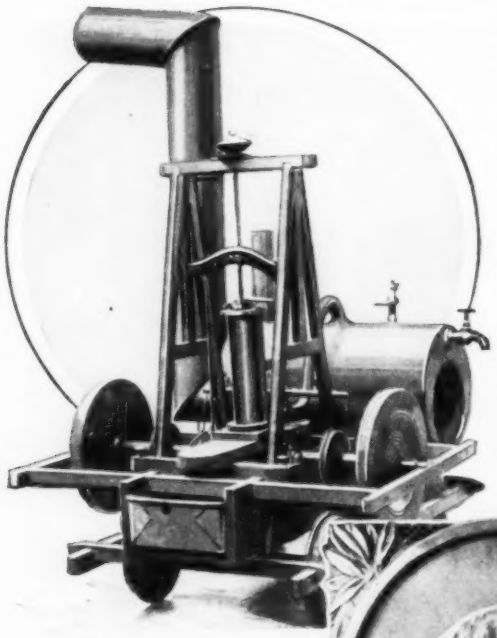
"Another patent was obtained on a process for curing concrete roads quickly. Ordinarily, this requires several weeks. The roadway must be kept damp or covered with some protection such as straw. A chemist created a colloidal emulsion with the property of drying slowly. When applied to new concrete, it hastens the curing process."

The public has misjudged inventors. The prevailing notion is that invention is a profession which men practice for profit. But that is only partly true. If invention were purely business, it would soon be systematized; corporations would develop monopolies. But today, as always, the individual inventor still holds the strongest outposts. No great research laboratories can oust him. Wherever man demands the assistance of tools and forces, invention flourishes.

Surely, an inventor needs money, but in this he is no different from his fellow men. In the throes of creation, an inventor resembles a writer. The cogs in his head are manufacturing ideas and creating situations. There is a plot and an end product in every machine. Some parts play leading roles; others are minor characters. The importance of an invention is the measure of the inventor; every machine, every device that passes through the patent office bears the trade-mark of the one who conceived it; it carries the imprint of his mind. Inventions, like plays and plots, have personalities.

Since brains and ideas are the inventor's sole assets, he is an individualist, like the writer and artist. Inventions cannot be manufactured mechanically, nor can they be made to order. All the great corporations maintain elaborate research staffs, yet they are dependent on the output of independent men who cultivate a natural instinct for contrivance.

Many corporations have hoped for the disappearance of free-lance inventors,



for it is they who conceive the radical innovations that change the globe's face. The free lance has those rare dreams that erect industries and generate vast wealth.

For years the science of radio was afflicted with a howl which came from the vacuum tubes. The corporation staffs sought to kill the howl. Came a Russian inventor, Leon Sergyevich Theremin, and produced a device that converted the howl into actual music.

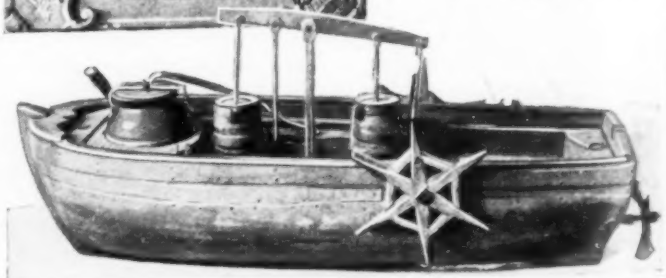
No less amazing is the case of Colin Kyle, a California school-teacher. He applied an age-old principle to a modern loud speaker. Radio found a golden voice; Kyle found fame.

Age seems to have little influence on an inventor's talent or activity. Edison earned his retirement long ago, yet he attacks the most difficult work zealously. He recently revealed that rubber is found in a great variety of plants, and some may be exploited commercially. The common goldenrod is an example.

When he invented the acoustic tile cell for correcting echoes and reverberations in auditoriums, Emile Berliner was well past middle life. He had already invented the telephone transmitter, the radio microphone and the disk phonograph ecord. Whenever I visited him, he was busy improving his old inventions or devising new ones. Besides his own work, he was interested in other sciences. His helicopter was the first successful airplane of that type. It is now in the national museum.

The geographic distribution of inventors has just been called to the attention of the patent office. One investigator declared that the Swiss are the most inventive people; that is, on a population-ratio basis, Swiss citizens lead other nationals in the number of patents taken out. His figures indicate that, in proportion to population, American citizens take out two-thirds as many patents here and about one-sixteenth as many abroad as do Swiss citizens.

In 1925, per million inhabitants, Switzerland received 930 patents abroad, against Aus-

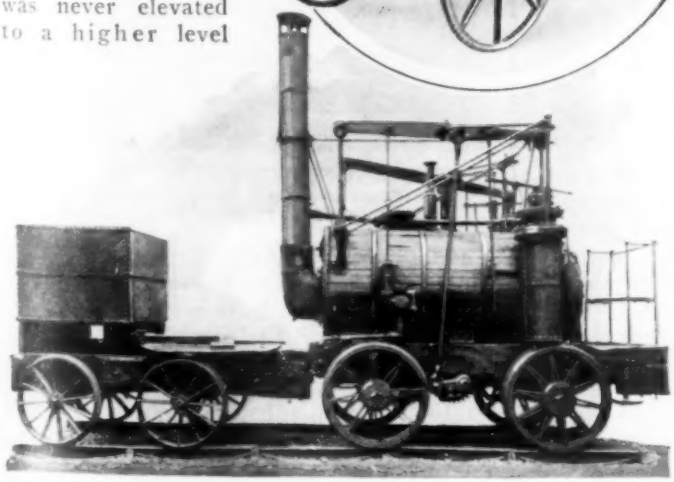


Model of Fitch's Railroad Locomotive; the Fitch Memorial Plaque on State Capitol at Hartford, Conn., and Model of Fitch's First Screw Propeller; He Is Credited with Being First to Apply Steam to Propelling Vessels

tria's 299, Germany's 271, France's 195, Britain's 188, Belgium's 180 and United States' 160. In number of patents granted to their own nationals at home the following ratio obtains: Switzerland, 542; United States, 382; Belgium, 283; France, 264; Austria, 239; Britain, 191; Germany, 186.

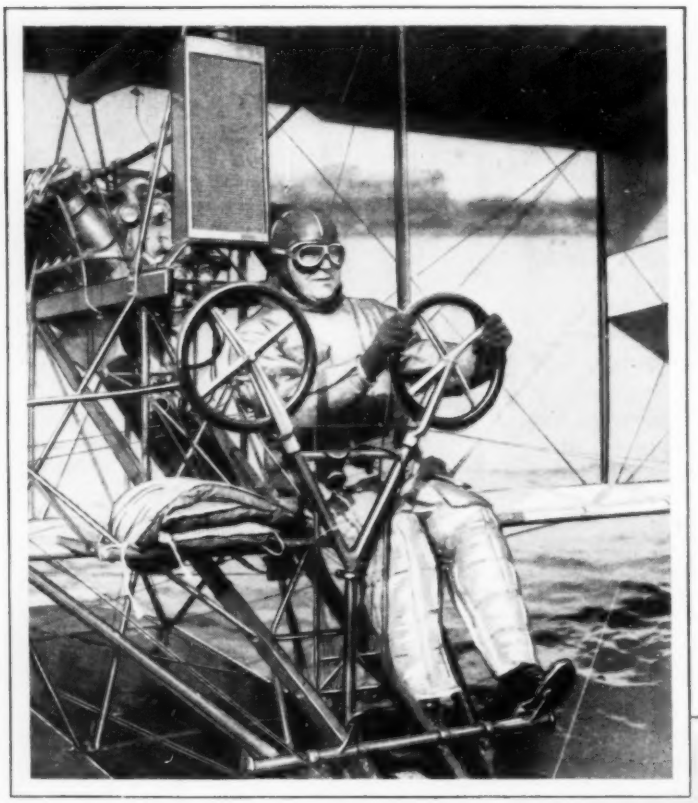
The case against American invention would seem very distinct were it not for the difference between the Swiss and American patent systems, which the investigator failed to point out: While Switzerland employs the "registration" system, America uses the "examination" system. Almost anyone who pays the proper fee may have a patent registered in Switzerland—although there are certain forms which the specifications must follow. But the American patent office rejects almost as many applications as it accepts.

If one considers the area bounded by the Mason-Dixon line on the south, the Canadian border on the north, the Mississippi on the west and the Atlantic ocean on the east, one finds more inventors and inventive talent than in any other spot in the world. Invention was never elevated to a higher level than in those parts; inventors were never more fertile, nor did they ever receive greater rewards.



Modern Engines Retain Many of the Essential Principles of These Early Inventions; Richard Trevithick's High-Pressure Boiler; the Selden Automobile, and "Puffing Billy," Built by Hedley in 1816

Patent office records show that there are certain districts in Connecticut, New York, New Jersey and Pennsylvania where the populations may boast a matchless concentration of inventors. Europeans wonder and question the Yankee's production in invention. Since Americans sprang from European stock, the only answer is that the United States cherishes and stimulates inventors. Our government makes special laws to protect them. It gives patents which guarantee against infringement. The government recognizes three parties that benefit by inventions:



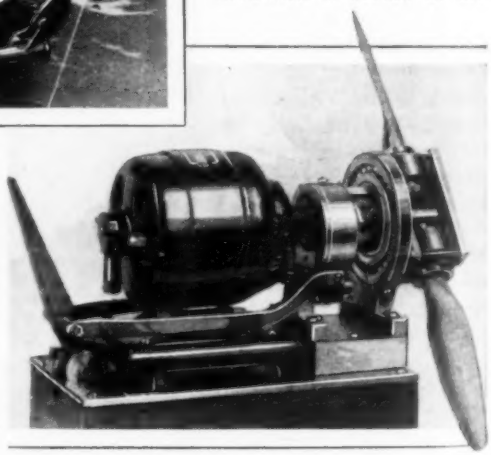
the inventor, the manufacturer and the public. Always it is the inventor who receives first consideration in a dispute, for the aim of American legislation is to give him both profit and priority, even though the manufacturer may suffer the greater loss.

In American social life, the inventor commands respect and admiration. He is recognized as the root and foundation of our national strength and wealth. No other country offers such handsome bounties for his work.

It is different in Europe. France is a case in point. Her people are among the most imaginative. In chemistry, in aeronautics, in engineering and in architecture, Frenchmen contributed many basic ideas. But because her patent laws are defective, France was unable to give justice to her inventors.

If France had been more sympathetic toward Leon Scott de Martinville, she might have encouraged him to perfect his "phonoautograph" which he invented in 1857; it was without doubt the forerunner of Edison's phonograph. Martinville's instrument consisted of a thin membrane to which was attached a delicate lever. The membrane was stretched over the narrow end of a funnel. The end of the lever was placed against a paper cylinder covered with soot. When sounds were transmitted to the membrane and the cylinder was rotated, the oscillations of the marker were recorded, and tracings of vibrations obtained.

The case of Charles Tellier is another example of a brilliant Frenchman who found no encouragement from his government. In 1868, he invented a series of air-

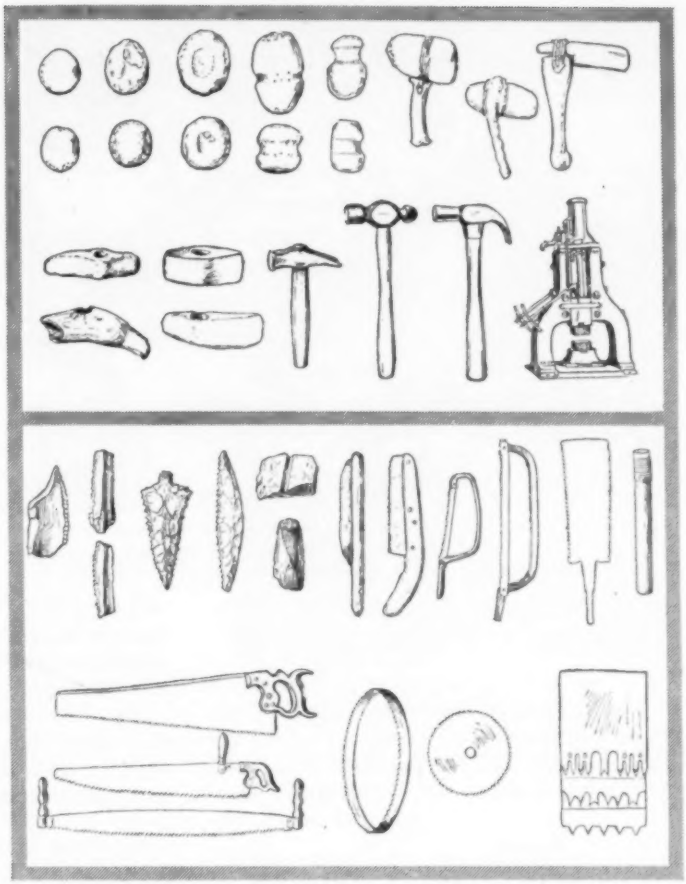


At the Controls of an Early Airplane, and Reversible Propeller Developed by Army Air-Corps Engineers

cooling devices and equipped a steamship with his invention. When the vessel returned from South America with a cargo of meat, French cattle raisers were alarmed over this sudden competition and had the shipment condemned. But it was taken to London, sold and eaten. The British purchased Tellier's invention for a trifle and organized refrigerated-steamship lines. The whole system of modern refrigeration and refrigerated carriers started with Tellier's invention.

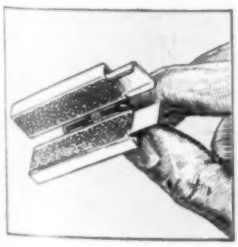
In 1854, when Alexander Graham Bell was a child in Edinburgh, Scotland, Charles Bourseul published an account of how he had obtained electrical transmission of speech. He set up his first telephone apparatus in St. Cere, and spoke with his friends over a short line. Frenchmen jeered at Bourseul. The government, no doubt, saw his article in L'Illustration, in which he recommended the use of a flexible plate which would vibrate with the varying pressure of air and thus open and close an electric current, and a similar plate at the receiving station.

England has good patent laws, but the adoption of labor-saving machinery and household comforts has been slow. The possibility of invention in Canada is unusual. An undeveloped country, it offers the inventor every incentive for production. Modern machinery blazes the Canadian trail. In their attitude toward inventors, Canadians are not unlike Americans. The recently amended patent laws provide both reward and encouragement.



The Life Stories of Two Familiar Tools; the Hammer and the Saw from the Stone Age until the Power Age of Today

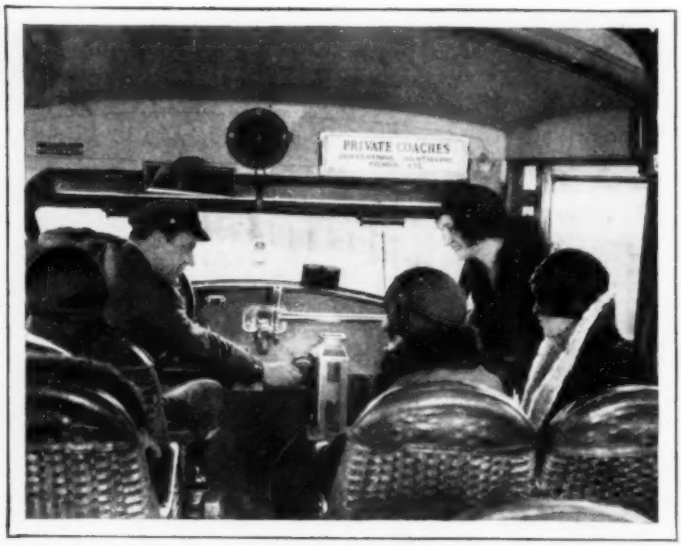
CLEANER KEEPS STEEL TAPE FROM BECOMING RUSTY



Keeping the steel tape clean and free from rust is simplified with a small pad that is snapped on the tape close to the case. A scraping side of two lips extends away from the case and as the tape is drawn through, these lips remove dirt and dust while the oiled pads behind them clean and condition the steel before it enters the case. The pads are interchangeable. The cleaner is intended to prolong the life of the tape while keeping the characters from becoming disfigured or obliterated.

PRINTING PLATE MADE QUICKER BY METAL SPRAY PROCESS

Metal plating by spraying, a process evolved by a Swiss engineer, is constantly invading new fields, the latest development being a "gun" by which even such a refractory metal as chromium can be sprayed on other metals and materials. The process has been applied to the making of printing plates as a quicker substitute for the slow electrolytic method. By metal spraying, such plates can be produced in from ten to fifteen minutes.



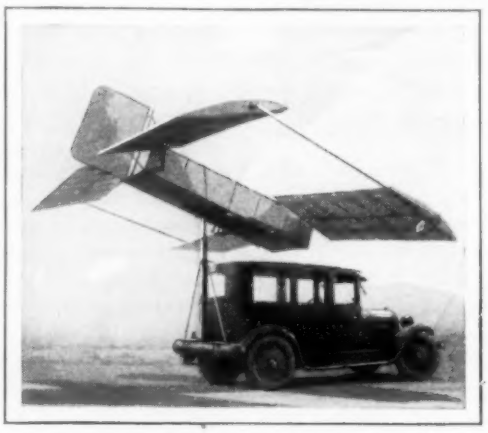
Interior of Pittsburgh Motor Coach in Which Passengers Are Entertained with Radio Programs; the Driver Operates the Radio Receiver

BUS IS EQUIPPED WITH RADIO TO ENTERTAIN PASSENGERS

For the entertainment of passengers, a Pittsburgh bus company has installed radio sets in the motor coaches used on the city streets. In addition to driving and taking fares, the bus operator also controls the radio set from a dial on the instrument board.

AIRPLANE ATTACHED TO AUTO AIDS IN TRAINING PILOTS

To aid in training pilots and give passengers the thrills of flying without actually losing contact with the ground, an airplane is attached by a metal framework to the rear of an automobile, the plane itself extending over the top of the car. When the auto is driven about, the pilot keeps his plane on an even keel by manipulating stick and rudder bar like those on an ordinary ship. The front wings act as ailerons and the rear as elevators. The device is mounted on an air cylinder and supported by an extension rod. When at rest, the air pressure equals the weight of passenger and plane, but when in motion, the increased pressure causes the ship to move up or down on the rod as in a climb or dive. The pilot duplicates the movements of the auto driver with the plane control.



This Combination Is Used for Training Aviators and to Give Passengers Flying Thrills in Safety

MINING DIAMONDS BY DIVING

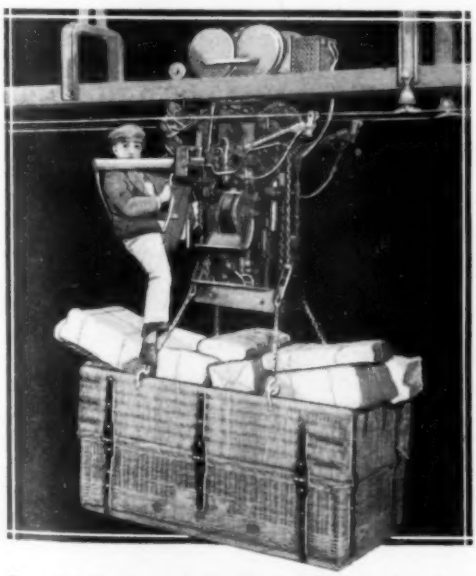
Picking diamonds from the dangerous rapids of the Araguaya river in Brazil, divers have been risking their lives and meeting with tragedies in one of the most perilous mining exploits in the world. The gems were discovered some time ago in the river bed between steep cliffs and where the water was from twenty-six to fifty feet deep. Stones valued at nearly $250,000 were gathered in a comparatively short time, and a diamond rush followed. The sharp rocks of the cliffs cut the air lines used by the divers, footholds were insecure and one man was swept away and lodged between two bowlders where he could not be extricated. His body was recovered a few days later, after the river had been swollen by rains and had washed it away from its moorings. At the workings along the river, wire cables are strung across to hold boats which are used to receive the gem-bearing minerals brought up by the divers who descend to the bottom of the stream slowly, sometimes on special ladders.

GLASS-PACKED MEALS COME READY TO SERVE

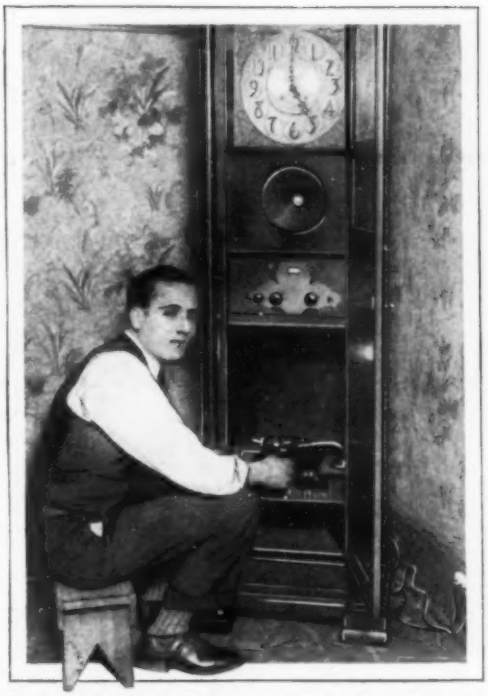
Single packages holding in individual glass containers a sufficient quantity and variety of foods to make a complete meal are being placed on the market to save the time of a busy housewife faced with an emergency. The foods are grouped in comprehensive, well-balanced menus and the entire meal is ready to serve when heated. Quantities for two, three or four persons may be obtained in several different types of packaged meals, including those for the formal dinner, light lunch, picnic dinner and breakfast package. One dinner contains tomato juice cocktail, stuffed olives, boned chicken, string beans, beets, cranberry sauce, sponge cake with chocolate sauce, salted nuts and coffee.

FLYING REDCAP TAKES BAGGAGE ON AERIAL RAILWAY

Trucks and wagons for hauling parcels and baggage from trains to baggage room in a British railway station have been replaced by an overhead trolley and basket to transport this luggage. The device resembles an enlargement of the department-store parcel-and-cash carrier system and is operated by one man who rides with the basket—a veritable aerial "redcap."



Overhead **Trolley and Basket for Transporting Baggage and Parcels at a Railway Station**



Talking Clock That Speaks the Hours and Half Hours; It Also Contains a Radio and Phonograph

TALKING CLOCK SPEAKS TIME ON HOUR AND HALF HOUR

After considerable experimentation, a Philadelphia man has produced a clock that speaks the time. The instrument consists of a combination talking clock, radio and electric phonograph, all installed in a grandfather case. The clock not only speaks the hours and half hours, but also may be made to tell the time in the form of a cheerful greeting, such as "Good morning—six o'clock." The cabinet contains an electric radio receiver with dynamic speaker which is used for the talking clock voice, the radio and the phonograph reproduction

A SANITARIUM FOR GOLDFISH

In Toronto there is a special hospital and sanitarium catering exclusively to goldfish. There the fish often undergo surgical operations and are treated for many different kinds of ailments. It has been found that the fish are subject to many ailments that afflict man, and for many diseases the treatment is the same.

Museum Exhibit of the Beautiful Egret Whose Snowy Plumes Almost Resulted in Its Extinction

MOST BEAUTIFUL BIRDS SAVED FROM EXTINCTION BY LAW

Legislative and police powers of several states, and funds supplied by interested persons, have been used successfully to save from virtual extinction the American egret, probably the most beautiful bird in this country. A few years ago, these birds were slaughtered in large numbers to obtain the fine plumes worn by the female snowy egret during the breeding season. The plumes, known as aigrettes when worn on women's hats, sold at $50 an ounce, and each female yielded about a dozen plumes, representing two ounces of feathers. For each bird killed, however, two to four young egrets died of starvation in the nest. These birds originally were abundant from the Great Lakes to the Gulf of Mexico, but finally were killed off until they made a last stand in southern Louisiana and Florida. Private property at first was set aside for them as a refuge, and later Louisiana, Florida and California passed laws protecting the birds forever.

THOUSANDS CAN HEAR PIN DROP IN HOLLYWOOD BOWL

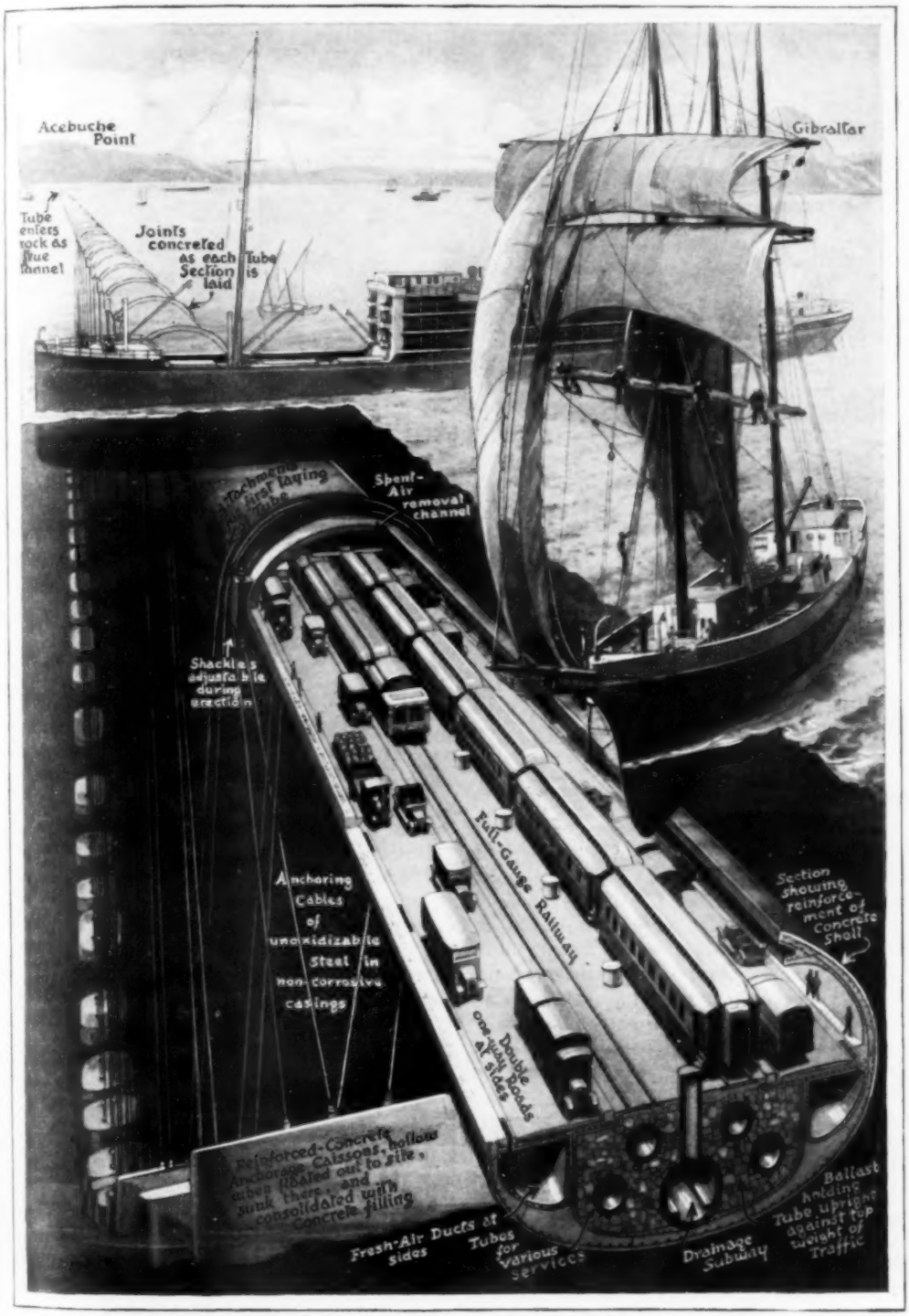
Through sound reflectors recently installed, 25,000 persons can hear a pin drop on the stage of Hollywood bowl. In the tests a birdshot weighing about one-thousandth of an ounce was dropped eight inches on a kettledrum and the noise was heard in every part of the bowl. The reflector is a half shell of a huge cone, forty-five feet high at the front of the stage and eighteen feet at the rear. It is made of thirty-six tons of structural steel and padded inside and out with sheets of asbestos. So carefully has it been designed that it directs more sound to those 550 feet away than to persons in front-row seats, because the close-up audience gets enough sound from direct waves. No electrical amplifiers are used. The reflecting cone is mounted on a portable stage.

RADIO LOCATES WATER PIPES WITHOUT DIGGING

Using Radio Apparatus to Locate Buried Pipe Line

To prevent digging up the streets over a considerable area, a frame radio aerial and what resembles a portable wireless set are being used in London to locate underground water mains. When the aerial is directly above the pipe the instrument transmits a buzz which is heard by the operator through earphones.

STRANGEST TUNNEL TO JOIN EUROPE AND AFRICA


Acebuche Point
Gibraltar
Tube enters rock as true tunnel
Joints concreted as each Tube Section is laid
Spent-Air removal channel
Shackles adjustable during erection
Full-Gauge Railway
Anchoring Cables of unoxidizable Steel in non-corrosive casings
Section showing reinforcement of Concrete Shell
Double one-way Roads at sides
Reinforced-Concrete Anchorage Caissons, hollow when floated out to site, sunk there, and consolidated with Concrete filling
Fresh-Air Ducts at sides
Tubes for various Services
Drainage Subway
Ballast holding Tube upright against top weight of Traffic

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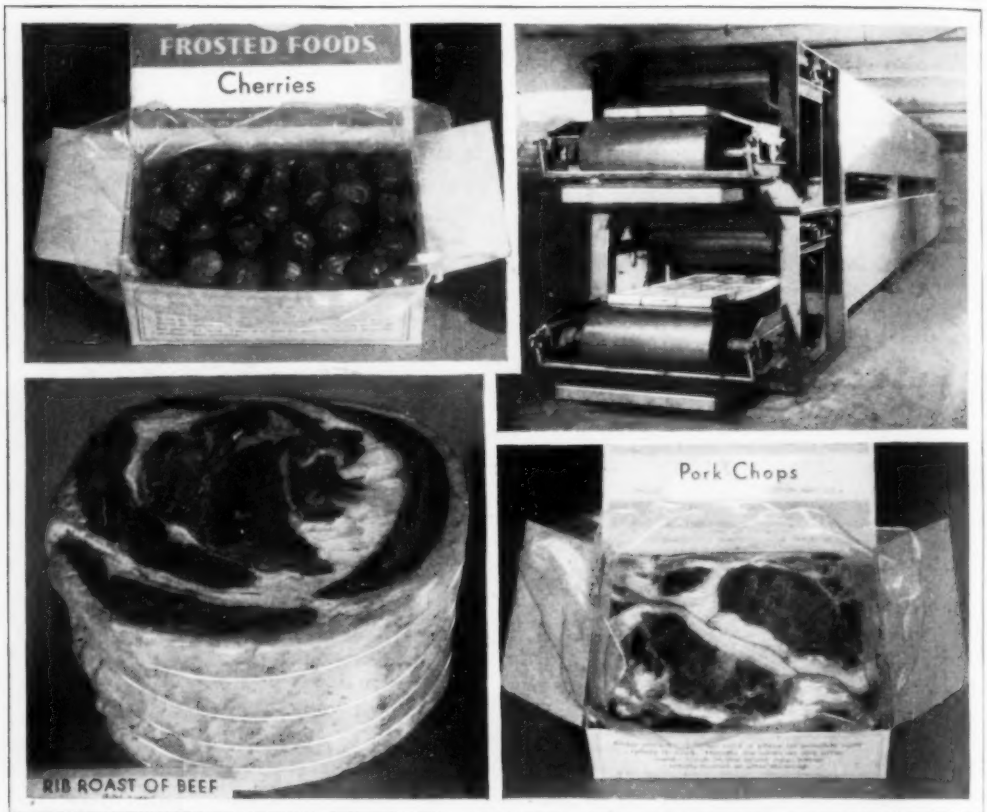
Artist's Drawing of Proposed Gibraltar Tunnel, a Huge Concrete Tube, to Connect Continents of Africa and Europe across the Narrow Gap of the Straits of Gibraltar

QUICK FREEZING PROMISES TO LOWER FOOD COSTS



Meats and Fruits, in Uniform, Handy Packages, as Prepared for Consumption after Rapid Freezing, and Type of Machine in Which the Products Are Frozen

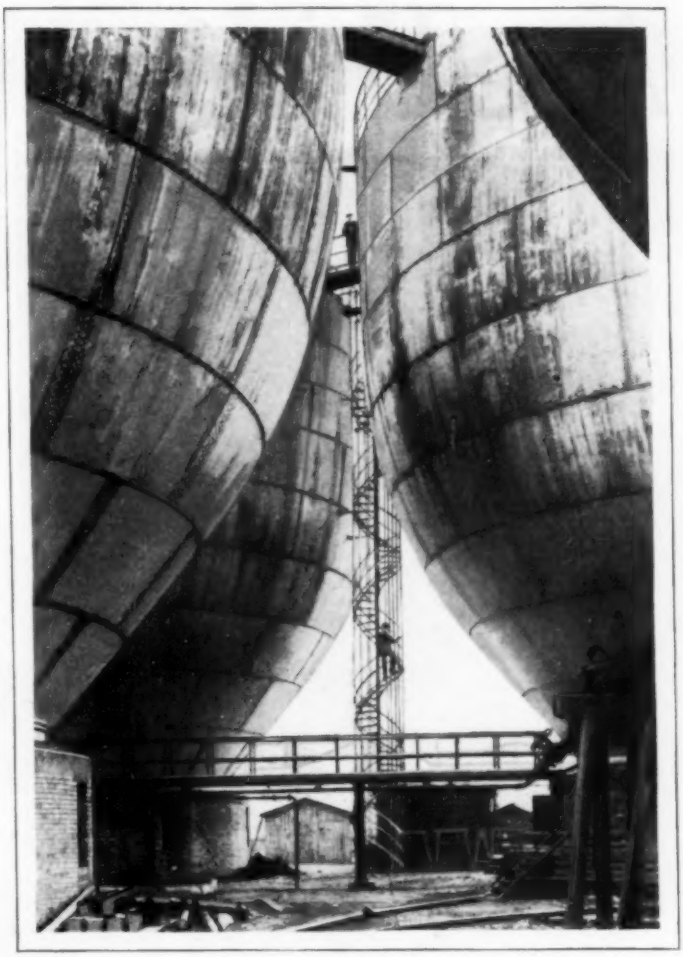
Perishable foods of almost every kind, sold in uniform, frozen packages with a minimum of waste and at probably lower prices, will be available at any season of the year as a result of a recently developed quick-freezing process which keeps foods with no loss of flavor or nutritive value. Fresh vegetables and fruits, oysters at all times of the year and other foods usually procurable in palatable condition only at certain seasons of the year, can now be enjoyed at all times.

The virtue of the rapid freezing as compared to the usual slower processes lies chiefly in the fact that when the cold is applied quickly and freezing is fast, much smaller ice crystals are formed. In the slower methods, the crystals are larger. They break the tissues and cells in meats and vegetable products with the result, especially in meats, that the liquids which form much of the nutritive value and the flavor of the product escape and are lost. There is but little cell destruction in the rapid freezing since small crystals are formed, hence the foods retain their original flavor, freshness and nutritive qualities and at the same time are protected against decay.

To freeze foods by the new method, they are placed in a machine, the chief feature of which is an arrangement of two flexible, moving belts of monel metal, one above the other. The cartons on the lower belt are drawn into a freezing tunnel while the upper belt drops down upon the food but not so hard as to crush it. When the machine is properly loaded, a calcium chloride brine, at a temperature of about fifty degrees below zero, is washed against the reverse side of each belt but none of the liquid is allowed to come in

contact with the food. The intense cold quickly penetrates the belts and the products, freezing them in from one to two hours and forming small ice crystals that do not break up the cell tissues and damage the food.

Development of the process, it is shown, will permit the producer to freeze and ship only the superior grades and the better cuts of meat and fish, while the other parts can be utilized for by-products. The yields of abundant seasons can be preserved over slack harvests, thus equalizing market conditions, and shipping expenses will be reduced through reduction of waste and extra handling. Stores selling the frozen products will be equipped with large refrigerator counters and cases where stocks can be kept indefinitely.



Storage Tanks at a Big Dye and Chemical Works; the Odd Shape Affords Large Capacity and Eliminates Unequal Strain

VACUUM CLEANER FOR STREETS

Resembling an army tank in appearance, a street cleaner employing the vacuum principle is being used in Berlin. The gasoline-operated cleaner sweeps the streets, and also sprinkles and mops them in one operation.

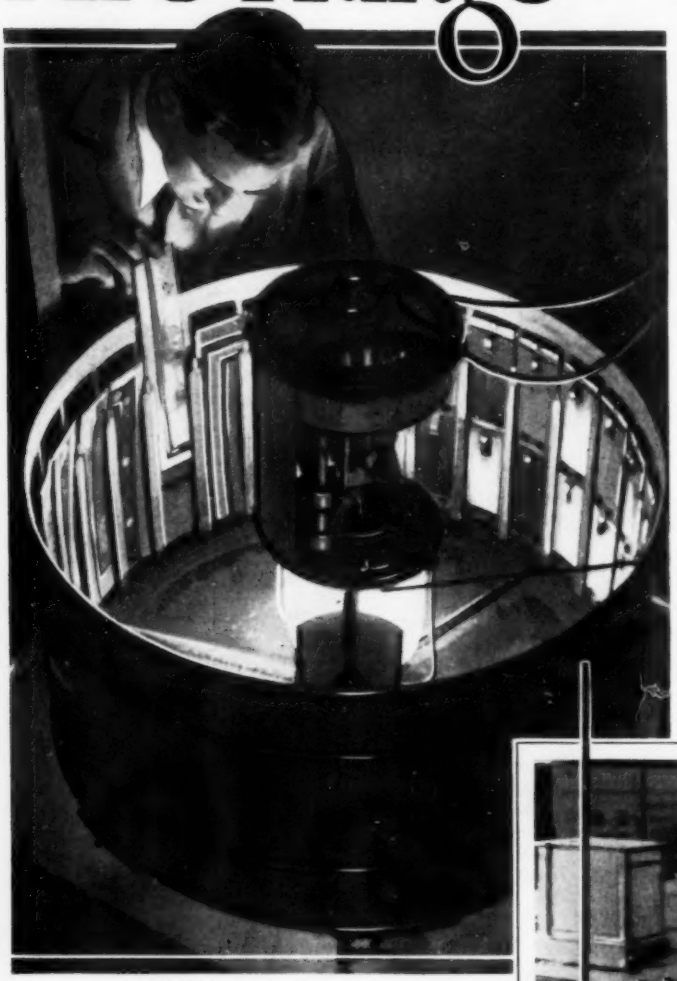
Street Sweeper That Works Like Vacuum Cleaner

TANKS SHAPED LIKE BALLOONS FOR GREATER STRENGTH

Huge spherical tanks, resembling large balloons, are being widely used in this country and abroad for the storage of chemicals, such as are used in the manufacture of dyes, and for other liquids. One reason for the construction of a tank of this shape rather than a cylindrical or rectangular one is that there is no undue strain on any one side of the tank either from the weight of the liquid or the pressure of gases that may form inside; less metal is also required to build it.

¶Fireproof clothes for airmen are being used by the British air forces.

Are Things *as* GOOD



By CRAG DALE

HOW often have you heard the remark, "They don't make 'em like they did in the good old days"? and how much truth is there in it?

To answer these questions, to speed up the wear and tear of time so that a few hours will reveal faults it ordinarily would take a lifetime to discover, is the job of Dr. Ellery H. Harvey, head of the "proving plant" of one of the greatest merchandising houses in the world.

There are some queer jobs in this plant. One man smashes dishes and glassware, and is paid to do it. Trunks are thrown from a roof to the ground, nine stories down, to see whether they will break. Then there is the mattress tester! Sleeping like a log is no idle phrase here, for they toss a real log upon a mattress to test its resiliency.

Doctor Harvey himself has devised many of the surprising ways of finding out just how well some 35,000 products "stand the gaff." He is a sort of commercial detective who is engaged in throwing light on any possible flaws in the cases of goods that are sent to him to be inves-

Measuring Effect of Synthetic Sunshine on Paint Samples, and Testing Absorption Qualities of Cloths; Conditions of Natural Exposure Are Accurately Duplicated

as they Used *to* Be?

tigated. One of his most interesting tests recently was conducted to determine how long the platinum tip on fountain-pen points would last. He constructed a motor-driven hand that traveled in a changing circle over an ordinary sheet of writing paper, and

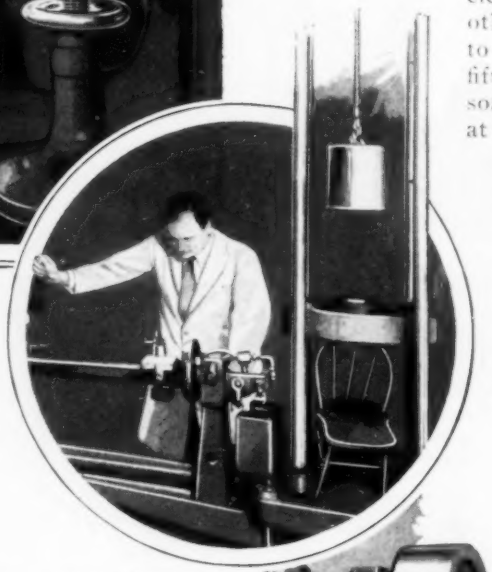
How Durable Are Dishes? With This Swinging Weight, the Tester Can Determine the Strength of Blow Required to Shatter Plates, Bowls and Other Dishes

which held the pen at a constant angle. Force feeding of ink kept the flow constant. One pen traveled 156 miles before it stopped writing. That, he declared, is equivalent to 123 years of average use.

The wearing qualities of silk dress goods began to give Doctor Harvey much trouble when women began to insist on bright colors. Rayon stepped in and added to the trouble because manufacturers of real silk goods, in some instances, attempted to lessen the cost of silk by using a tin "filler." This filler was the woof thread in the fabric and is made of tin chloride. Tin chloride oxidizes under sunshine, and perspiration breaks it down rapidly. Laws of trade permit the use of as much as twenty-five per cent of tin chloride in making silk goods, but some manufacturers, spurred by hot competition, used as high as fifty-five per cent of the tin. In those cases the fabric breakdown was rapid.

Chemical analysis, of course, would disclose the quantity of tin in the goods, but not the length of wear under average conditions. The public wanted silk, or something that looked mighty like it, and the merchants had to provide it—even if it were half tin. So Doctor Harvey devised another machine; one that would do in a few minutes what weeks or months of wearing would do to a silk dress. Operating at normal room heat under ultraviolet rays and in reasonable humidity, Doctor Harvey's abrasive machine would deliver seventy-two rubs a minute on the cloth at the friction of the material rubbing against itself. Three minutes of rubbing was enough for heavily filled silk, while that containing no more than twenty-five per cent tin stood from three to four times as many rubs before breaking down.

By using the same machine, without the addition of ultraviolet rays or humid-



ity, a piece of medium-weight wool suiting for men is found to stand 50,000 rubs at the rate of seventy-two a minute. That gives an idea, though indefinite, since conditions must vary with individual instances, of how many times one might expect to sit down on a chair covered with like material before wearing out his trousers.

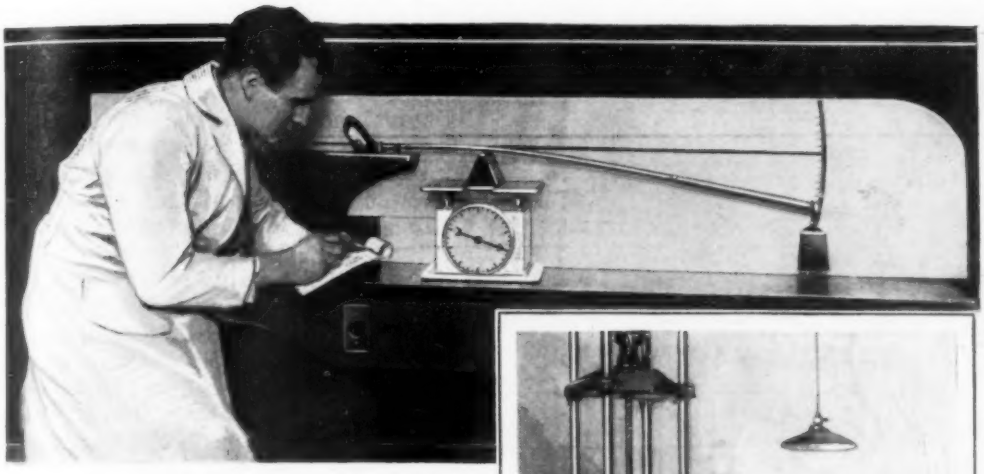
One of the most difficult methods of speeding up time has been successfully solved by Doctor Harvey in finding out the lasting qualities of paints, varnishes, lacquers and asphalt roofing.

"The flair for bright colors on linoleums, on weatherboards and throughout the house, gave us a lot of trouble at first," he said. "We just didn't know what we could guarantee. But now we have a machine which can tell us quickly about it. A piece of linoleum, for instance, is no better than the paint that is on it. When the paint breaks down, the whole fabric begins to go.

"In our 'weatherometer' we have effects that make one hour equivalent to one day of actual weather conditions. The painted metal panel is placed in the machine, and for three hours out of twenty-four is given a drenching downpour of rain and one hour of refrigeration at nineteen degrees, and then seventeen hours of blistering sunlight produced by ultraviolet lamps. The remainder of the time it is in the dark."

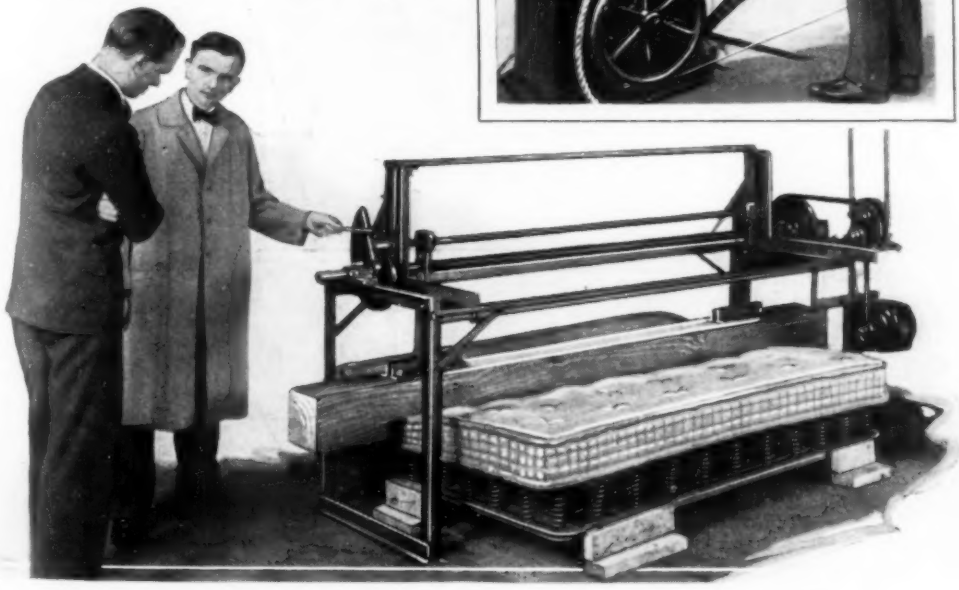
At what is considered proper intervals, the metal is taken from the machine, dry, and the unpainted side is placed on a bed of steel wool which is connected with an electric battery. Another contact is made to the metal and then fifty drops of salt or soap solution are placed at regular intervals over the area of the piece of metal. The operator then applies a platinum needle, attached to a set of radio-receiving earphones through which he listens. If there has been any break-

Measuring Strength of Saw, of Furniture, and the Wearing Qualities of Leather Samples; Special Machines Had to Be Invented for These Tasks

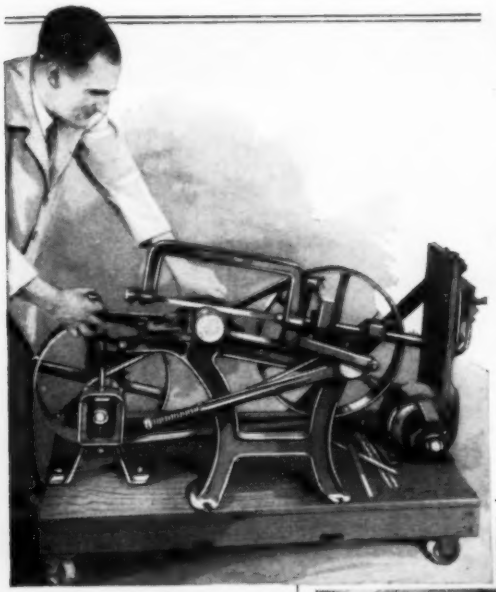


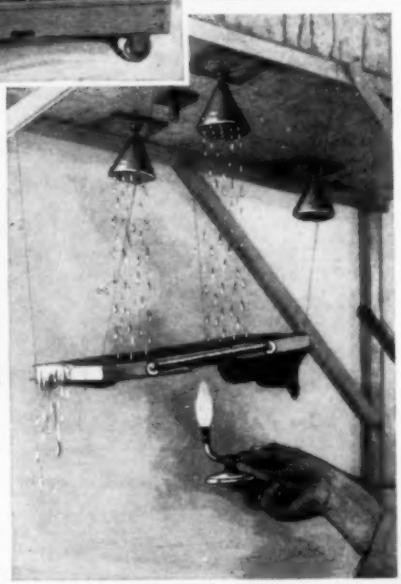
down or cracking of the paint, the operator hears a loud click as the electric contact is made on the wet spot by the needle.

The longest that the best grades of paint yet tested will stand under such a test is seventeen years, according to Doctor Harvey, and it took about three-quarters of a year to establish that fact. Painted wall paper—or more accurately, tinted wall paper—has given much trouble, too. The new bright shades, with their many variations and mixtures, have been difficult to obtain so that they will last against



Determining the Stiffness of a Golf-Club Shaft; Testing the Strength of Rope, and Putting the Springs and Padding of a Mattress through Tests That Reveal Their Resilient and Other Qualities; the Log Pounds the Mattress at Different Angles and with Varying Force to Test Sample's Durability





the brilliance of sunshine. So far, three years has been established as the longest time such paper can be warranted not to fade.

Another apparatus of more than passing interest in this laboratory of unusual things is the machine for determining the resistance of china against breakage. For this test a four-ounce steel weight is swung against the plate in ever-increasing arcs to measure the foot-pounds of resistance. The trick is to obtain a really thin dish which will stand some bumping around—one which the hurried housewife can drop occasionally without hearing the heartbreaking clatter of crashing china. Two and a half foot-pounds is established by Doctor Harvey as the smash that a plate or cup must stand before he can accept it.

And mattresses—what they go through before Doctor Harvey will give them his official approval is enough to discourage the best of them. A log is hooked up to machinery so that it pounds the mattress from almost every conceivable angle. If a mattress stands up under that for a week, it is good for a lifetime.

"Taken as a whole, a comparison of quality between an article that is made today and the same thing of twenty-five years ago will show many things are not so good today," declared Doctor Harvey. "On the other hand, the public is not so much interested now in how long a thing will last as how it will look. I'm speaking of clothing now; women's clothing in particular. But bear this in mind: If the quality of silk goods has deteriorated, that very deterioration has placed silk goods in the reach of many who could not afford it years ago.

"But it is difficult to discuss the question of relative goodness of things without advancing the thought that today we have so many more things than we had twenty-five years ago. Every year sees additions to the list of things the

Driving Hacksaw through Steel Bar; Testing Rubber Fabric's Waterproof Qualities, and Electrical Test on Paint; the Needle Makes an Electrical Contact if Paint Has Cracked on Metal

public desires. What they are enabled to save by buying silk with tin in it, or a suit with shoddy and cotton, they spend for some of the other items which, after all, make life more interesting, and which put within the reach of everyone those things which once were considered available only to the very rich.

"Yes, sir, the day of the spinning wheel definitely is gone, and while the socks and fascinators that grandma used to make might have lasted longer, the things of today serve their purpose just as well, if not better. Things may not be so good, in a technical sense, as they were in times gone by, but I believe that that very truth is partly responsible for the undeniable fact that living itself is better."

SPRING-WIRE FUR STRETCHERS REPLACE WOODEN FRAMES

Spring-wire stretchers for the drying of raw furs are replacing the laboriously whittled wooden frames which trappers have used more or less generally since the days when Indians bent saplings for the purpose. It was necessary to have a large assortment of wooden frames to accommodate various sizes of pelts, but the wire frame adjusts itself to any size. The spring wire holds the sides apart to allow sufficient circulation of air, thus drying the pelt more quickly and eliminating wrinkles. Prong steel clips under tension grip the side wires and thus keep the skin in any position. To remove the dried pelt, it is only necessary to compress the side wires.

Life Guards and Their Rescue Plane; a Lifeline Dropped from the Plane to Persons in Distress Is Carried to Shore by a Torpedo

LIFE GUARDS USE SEAPLANE IN RESCUE WORK

Life guards at Seaside, Oreg., use an airplane in rescue work. The craft carries a torpedo to which is fastened a long rope attached to a life preserver. The life-saving crew drops the preserver to persons in distress, and the torpedo carries the line to shore, the method being quicker than a boat rescue.

NAIL-LESS BANDS FOR BOXES REDUCE SHIPPING COST

Packing cases and boxes are strengthened with steel bands fastened with seals instead of nails. A stretching unit simplifies the task of putting the band around the box, and the ends of the strip are joined with a seal which may bear the trade-mark of the firm if desired. Use of the seal and the band makes it practically impossible for anyone to break into a case so protected, without detection, and the steel strip permits using a box with less timber in it, hence a saving in material cost and transportation charges.

Huge Soldier's Cap Atop Striped Pole Which Marks the Entrance to a Citizens' Military Training Camp Established in Russia

SOLDIER'S CAP MARKS ENTRANCE TO MILITARY CAMP

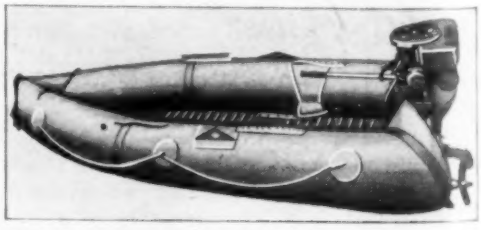
To observe the anniversary of the communist revolution in Russia, a training camp rally recently was held at Moscow. Entrance to the military camp was marked by a huge officer's cap placed atop a striped pole about which was fastened a rustic seat. In the camp, citizens were put through a strenuous period of military drill and maneuvers.

CRAFT TO TRAVEL OCEAN FLOOR UTILIZES RUBBER SHIELDS

For use in studying the bottom of the ocean, a craft invented by a Croatian engineer, is said to permit as many as six persons to descend at one time to much greater depths than heretofore possible and is so arranged that drawing and photography may be executed while the observers are on the sea bottom. One of the special features of the apparatus is an arrangement of rubber shields which resist extreme pressures and also afford a means of movement, as they admit air and water at one side of the craft and expel it at the other. In a trial, two dogs were lowered inside one of the diving chambers and kept there for twelve hours. When they were removed, it was found that they had suffered no ill effects and the air inside was almost as fresh as it was when the apparatus was lowered. The inventor points out that his principle could be adapted to the construction of submarines that could descend and operate at depths much greater than those reached by present types of underwater craft. The rubber shields are of such a texture that they resist external forces such as explosions. In a demonstration, a quantity of explosive was set off under the craft while it was submerged but it did no damage. Besides "making" its own air, the apparatus is fitted with powerful reflectors which permit an extensive view over the sea floor.

PORTABLE BOAT CARRIED IN CAR INFLATED BY EXHAUST

To save campers the expense of storing or hiring a boat, a portable pneumatic craft has been made in England to be carried on the running board or luggage



Portable Pneumatic Boat Carried in the Auto and Inflated from the Exhaust of the Car

rack of the auto. The boat may be inflated in three minutes from the exhaust of the car and is large enough to carry three persons. When stored for carrying, however, it packs in a bag smaller than an ordinary suitcase. It is propelled by a small motor at a speed of fifteen miles an hour, and may also be used, when inflated, as a bed, or turned upside down to serve as a diving board.

RIGID CHAIRS ARE NESTED TO ECONOMIZE SPACE

Rigid chairs, so constructed that they may be nested together, give all the space-saving features of folding chairs without their disadvantages or weakness. The chairs are of identical size and shape, and can be nested because the seat frame converges slightly toward the front, while the back of the seat is slightly higher than the front. The seat is made level by having the cushion thicker at the front. By this type of construction, a dozen or more chairs can be nested, each taking about two inches of space and resting on the floor on its own legs. They may be built in any period or style with any kind of backs and legs. If a seat pad is used, it is lifted up against the back of the chair when the chairs are nested.

PLANTS TREATED WITH RADIUM TO CREATE NEW TYPES

By exposing plants to radium, scientists at Iowa State college hope to produce new varieties of tomatoes and other products. The radium, imbedded in small needles, it is expected, will affect the plant cells in such a way that new, permanent kinds of produce will result and important facts may be learned as to the relationships between existing varieties. More than $8,000 worth of radium has been borrowed in order to carry out the experiments.

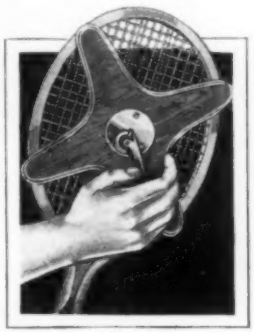
Miniature Gas Engine for Operating Model Planes or Boats; It Comes Ready for Assembling

SMALL GAS ENGINE OPERATES MODEL PLANE OR BOAT

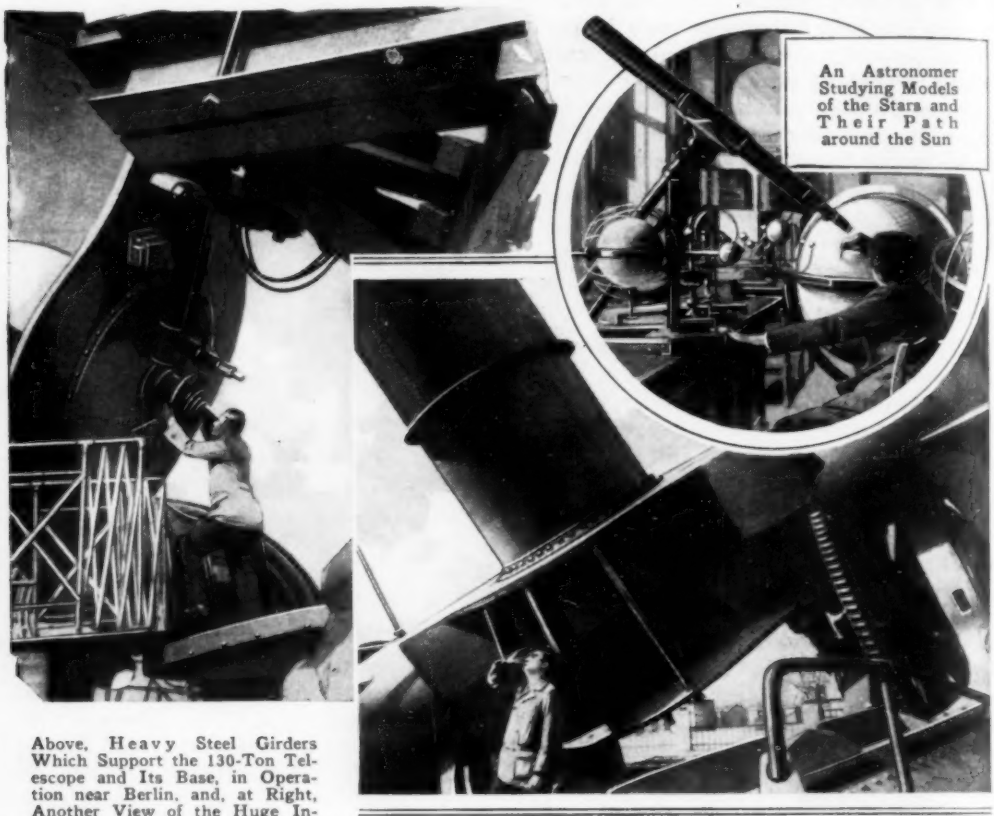
For operating model aircraft or racing boats, a model gasoline engine which develops up to one-fourth horsepower may be obtained complete by the model builder and assembled from detailed drawings to fit the apparatus for which it is to be used. It is a single-cylinder two-cycle engine weighing only two pounds and running at 1,500 to 3,000 revolutions per minute. The model is air or water-cooled, and all the parts come ready for assembling.

PRESS FOR THE TENNIS RACKET EXERTS EVEN PRESSURE

To keep the tennis racket in condition, a lightweight press is available that can be carried in position on the racket inside the racket cover. A locking lever clamps the implement in position, an even pressure being exerted at each of four contact points that are located above the racket rim.

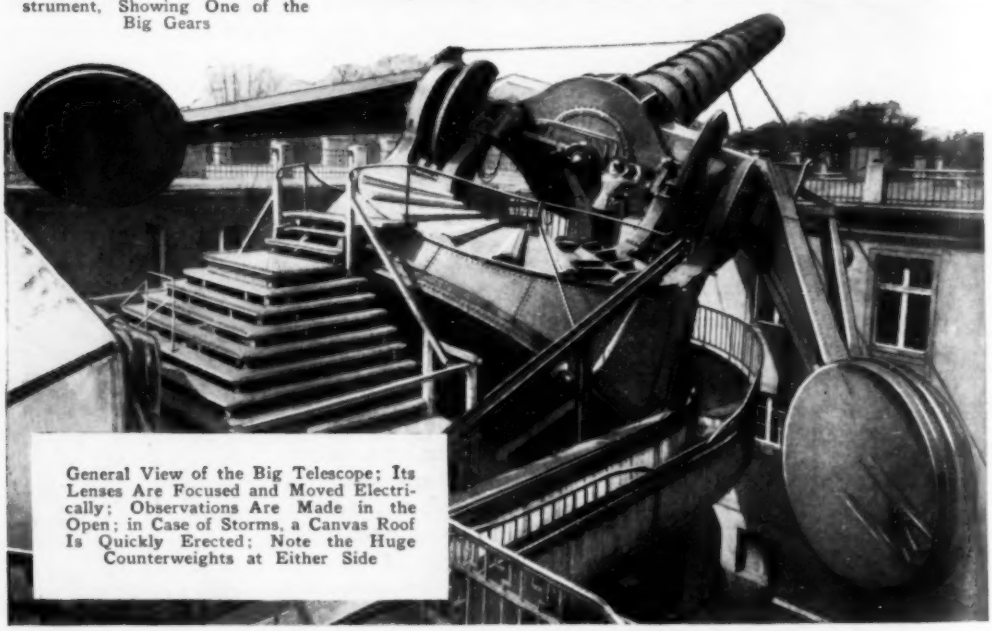


ASTRONOMERS' "BIG BERTHA" BRINGS STARS NEARER



An Astronomer Studying Models of the Stars and Their Path around the Sun

Above, Heavy Steel Girders Which Support the 130-Ton Telescope and Its Base, in Operation near Berlin, and, at Right, Another View of the Huge Instrument, Showing One of the Big Gears



General View of the Big Telescope; Its Lenses Are Focused and Moved Electrically; Observations Are Made in the Open; in Case of Storms, a Canvas Roof Is Quickly Erected; Note the Huge Counterweights at Either Side

SEAGOING GARDENS SUPPLY FLOWERS ON LINERS

Seagoing gardens have become a part of the modern ocean liner, and the nautical gardener tends his orchids and rosebushes in mid-ocean as does his brother in the greenhouse on land. The modern transatlantic liner carries a staff of gardeners for the conservatories filled with shrubs, exotic plants and blossoming vines. Big ships carry 1,000 plants or more and supply fresh flowers for the passengers throughout a voyage. Fog is the worst enemy of the flowers, for when salt water fog dries it leaves a coat of salt on the plants, and delicate blossoms wither and die. Ship gardeners select their plants in both foreign and home ports. Certain flowering plants, including rhododendrons, hydrangeas and azaleas, stand the ocean travel very well

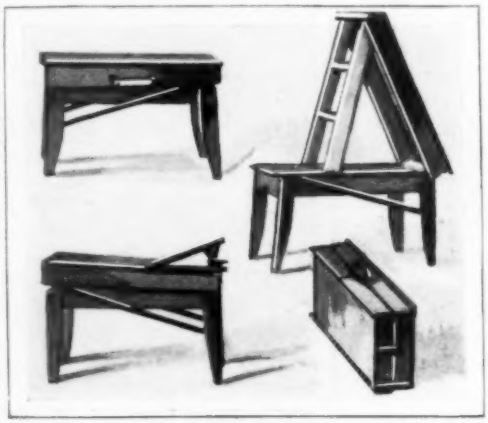
Brush Cutter, Operated by a Tractor, Used for Clearing a Trail through a Forest; It Cuts a Swath Eight Feet Wide

BRUSH CUTTER RUN BY TRACTOR CLEARS NEW LAND

Hundreds of acres of brush and small trees have been cleared from new land in British Columbia with a brush cutter operated in front of a tractor. The cutter consists of a V-shaped plow, the lower part of which projects about six inches and is equipped with a cutting edge. The cutter clears a furrow eight feet wide as it is pushed through the brush, which is thrown to either side. Wooden timbers between the plow and the operator protect the man on the tractor from falling trees. The cutter also is used to advantage in blazing a trail through the forest for roads.

TOOL BOX, BENCH AND LADDER CONTAINED IN SUITCASE

Several pieces of furniture that are handy about home or workshop are contained in a single unit, which, in one form, serves as a carrying case, thus making the unit compact and portable. In various forms, the case may be turned into a tool box, workbench, stepladder or chair. A trapdoor in the top gives easy access to the tools and may be fastened to the stepladder to form the bottom of the chair or the first step of the ladder.



Single Unit Which Can Be Converted into Tool Box, Bench or Ladder, or Folded for Carrying

¶Popular Mechanics Magazine does not publish the name of the maker or seller of any device described in its pages, but this information is kept on file and may be obtained free from our Bureau of Information.

Mirror Which Plays a Large Part in Arousing Interest of Pupils in a Children's Gymnastic School in Berlin

CHILDREN'S GYMNASTIC SCHOOL FITTED WITH MIRRORS

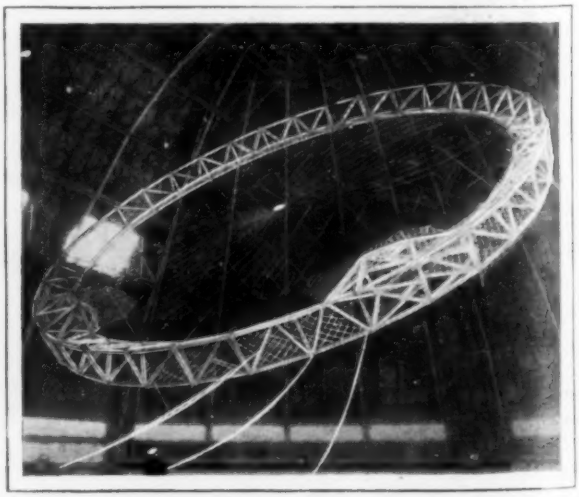
Mirrors play a large part in a gymnastic school for children in Berlin. The institution is open to children ranging from one to five years of age, and the large mirrors are placed before the horizontal bars and other apparatus to allow the youthful gymnasts to observe themselves and thus awaken their interest in the manner in which their exercises are performed.

GLACIERS' SPEED TOLD BY METAL SHELLS BURIED IN ICE

How fast does a glacier move? Only a short distance each year, present measurements reveal, but Swiss scientists, intent upon more accurate answers to the question, have started a series of experiments that will not be completed for 250 years, but at the end of that time, wise men of the future will know more about the speed of the ice masses than can be learned by living men. Metal receptacles, shaped like shells and containing records as to the exact time, location and depth of their burial, are being deposited in various glaciers, near their edges. Copies of the data are placed in the safe of the Swiss Academy of Science with instructions that the shells are not to be removed until the year 2180, when their location will be compared with the original place of deposit and the speed of the glaciers will thus be computed.

"CORNERSTONE" OF HUGE AIRSHIP RAISED INTO PLACE

Laying the "cornerstone" for a dirigible consists in hoisting into position a circle of metal composing the master ring. When the navy airship "ZRS-4" was started at the dirigible dock of the Goodyear Zeppelin corporation, at Akron, a mammoth 133-foot master ring was raised. To this member will be attached the metal girders extending to other rings as the aerial giant begins to take form.

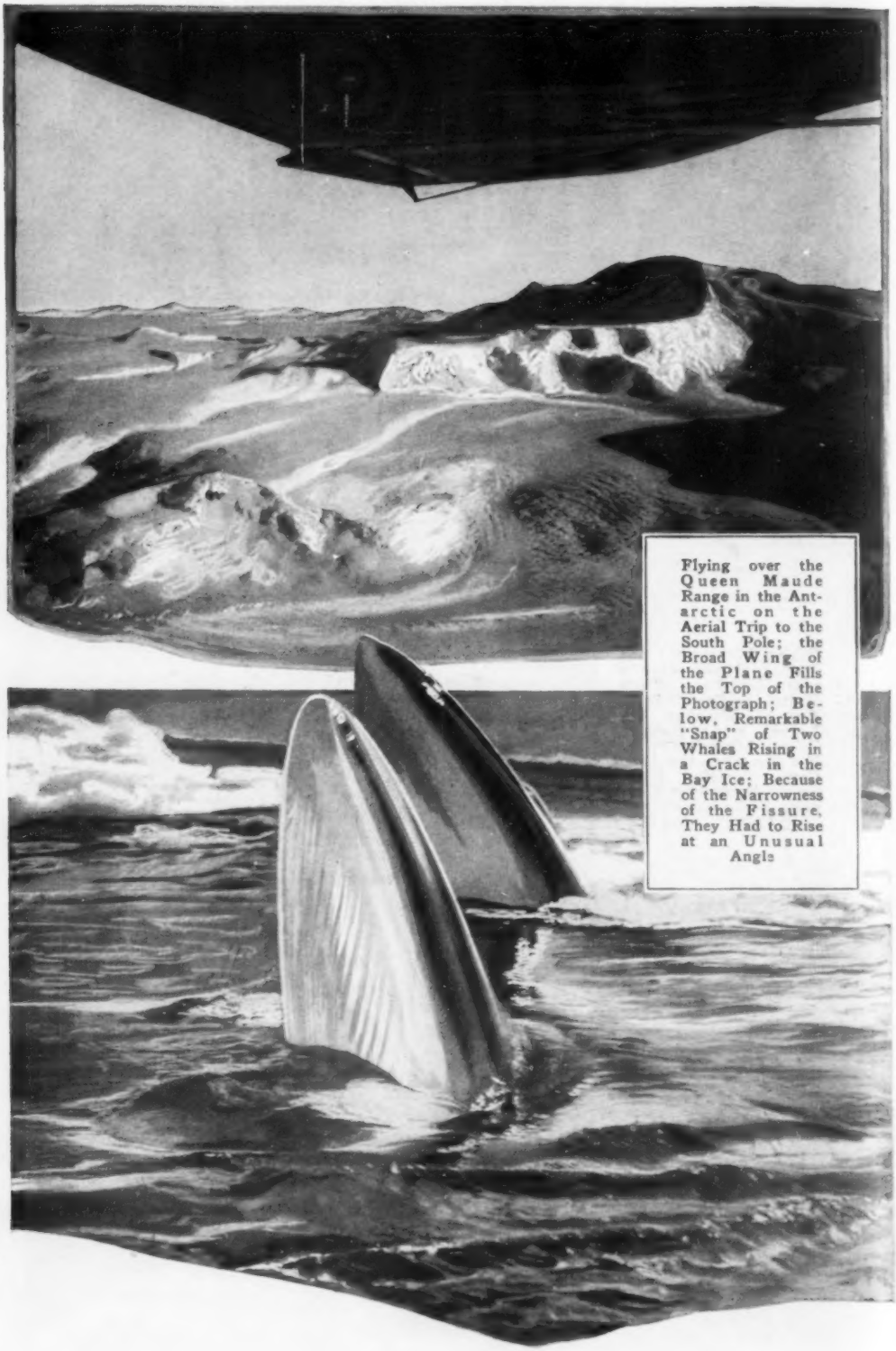


Hoisting into Position the 133-Foot Master Ring Which Constitutes the "Cornerstone" for a New Navy Airship

At the Bottom of the World with Byrd

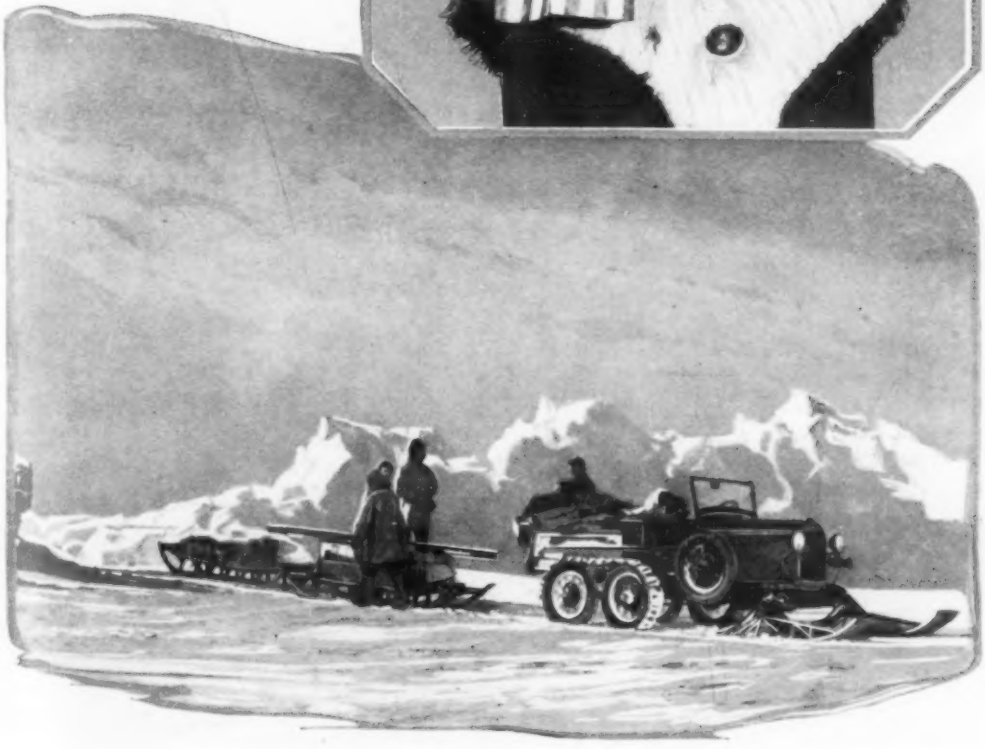
Taking Photographs and Making Observations near Big Berg Which Drifted to East Side of Bay of Whales and Lodged near Barrier; Below, Admiral Byrd in His Room at the Base Camp, Studying Plans for the Exploration Campaign While His Faithful Dog "Igloo" Looks On

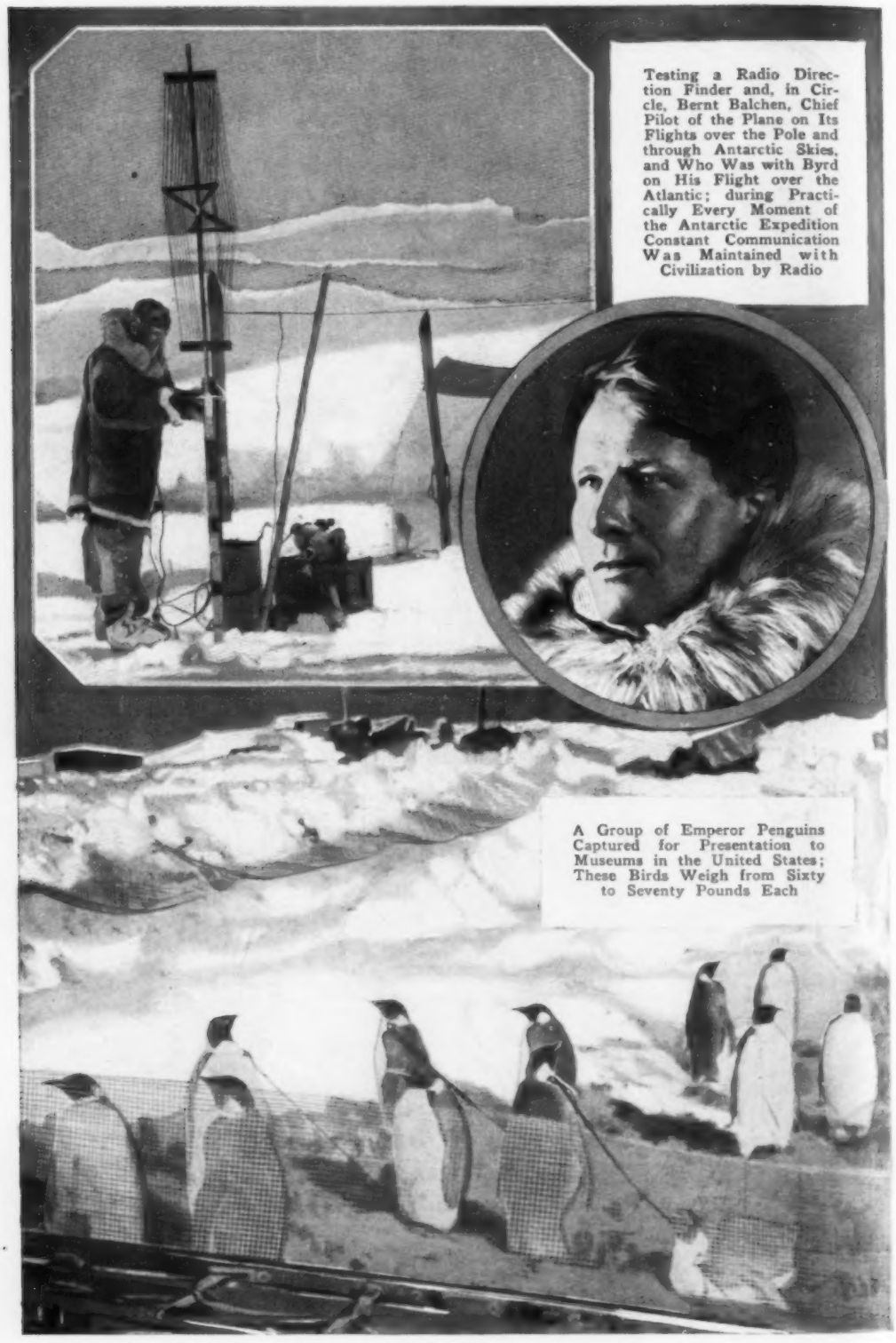
Photos © The New York Times Co., and the St. Louis Post-Dispatch



Flying over the Queen Maude Range in the Antarctic on the Aerial Trip to the South Pole; the Broad Wing of the Plane Fills the Top of the Photograph; Below, Remarkable "Snap" of Two Whales Rising in a Crack in the Bay Ice; Because of the Narrowness of the Fissure, They Had to Rise at an Unusual Angle

"Ski" and "Sky," Two Pups Adopted by Captains McKinley and Parker; Rear Admiral Byrd in His Furs and Holding the Flag and the Stone Taken from the Grave of Floyd Bennett and Dropped at the South Pole; Below, the "Snowmobile," a Ski-Equipped Tractor Which Was Abandoned Eighty Miles South of the Base; the Expedition Further Demonstrated the Remarkable Efficiency of Various Kinds of Mechanical Equipment

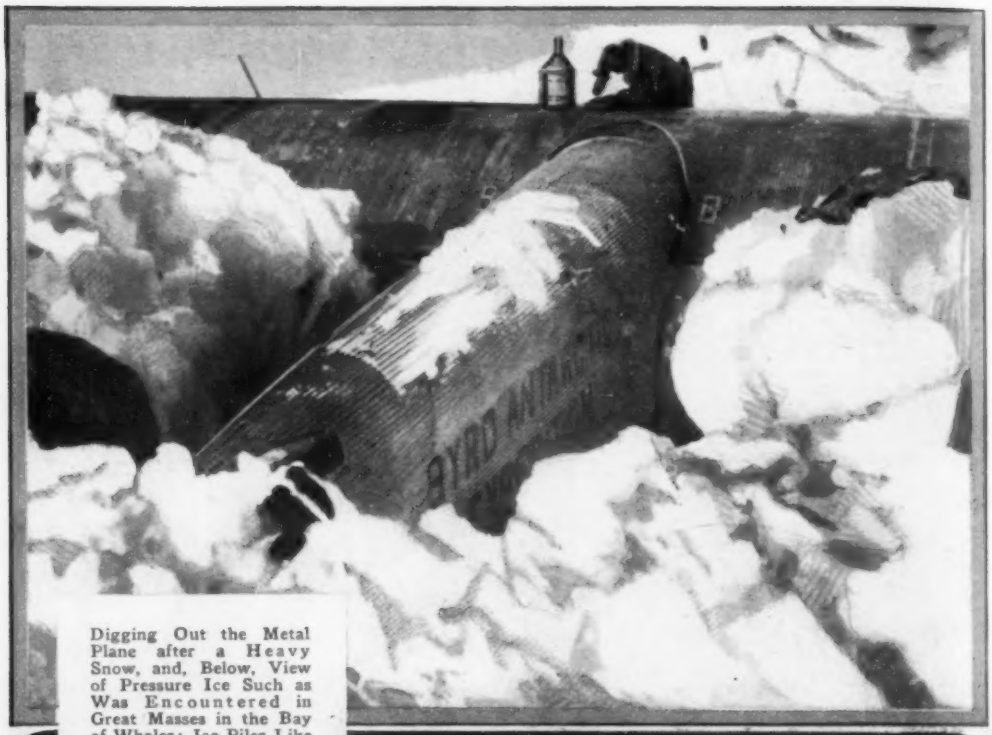




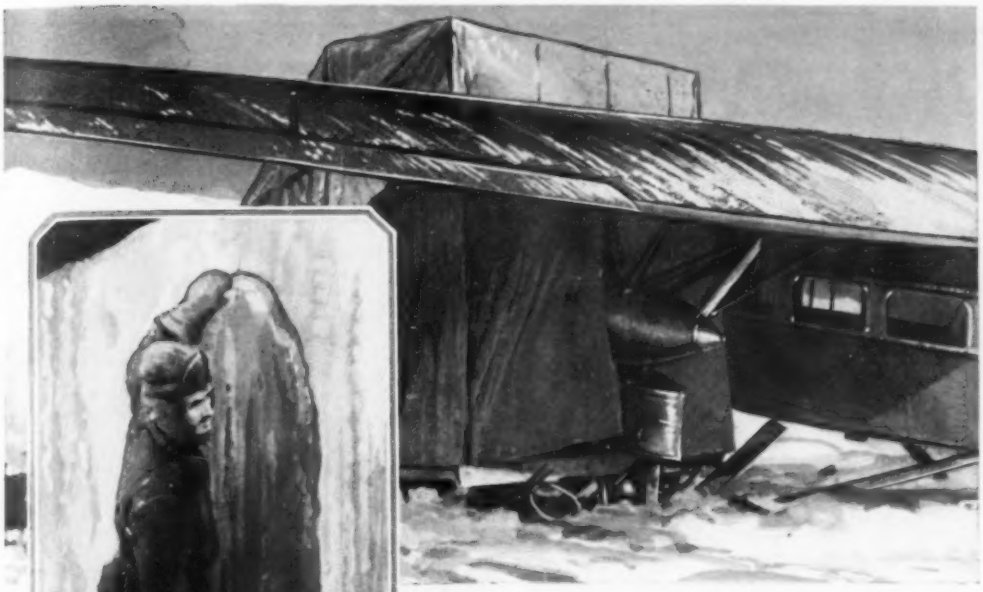
Testing a Radio Direction Finder and, in Circle, Bernt Balchen, Chief Pilot of the Plane on Its Flights over the Pole and through Antarctic Skies, and Who Was with Byrd on His Flight over the Atlantic; during Practically Every Moment of the Antarctic Expedition Constant Communication Was Maintained with Civilization by Radio

A Group of Emperor Penguins Captured for Presentation to Museums in the United States; These Birds Weigh from Sixty to Seventy Pounds Each

In Circle, Dr. Dana Coman, Who Was a Private in the French Army for More Than Three Years during the World War, Grew a Beard That Proved to Be One of the Wonders of the Expedition; at Right, Carl Petersen, Radio Operator in the Radio Room Where Contact Was Maintained with the Outside World throughout the Long Months in the Antarctic; Below, Making a House of Snow to Hold the Stacks of Supplies Seen in the Background; Great Care Was Taken in the Selection of the Materials for the Expedition and Sufficient Quantities Were Taken to Last a Long Time; a Special Supply Ship, the "C. A. Larsen," Was Acquired and Sailed from Los Angeles with Admiral Byrd to Join the Flagship, the "City of New York," at Dunedin, New Zealand; from This Point, the Final Voyage toward the Antarctic Was Begun; among Scores of Other Things Not Usually Associated with a Voyage of Adventure Were Various Musical Instruments and a Large Library to Help Entertain the Men of the Expedition during Idle Hours



Digging Out the Metal Plane after a Heavy Snow, and, Below, View of Pressure Ice Such as Was Encountered in Great Masses in the Bay of Whales; Ice Piles Like These Made Sledge Travel Slow and Dangerous; the Base Camp Was Established on the Bay of Whales and Served as the "Capital" of the Expedition with Its Living Quarters, Radio and Weather Stations, and Airplane Base; Little America Was Begun in December, 1928, and Byrd and His Men Lived There till February, 1930

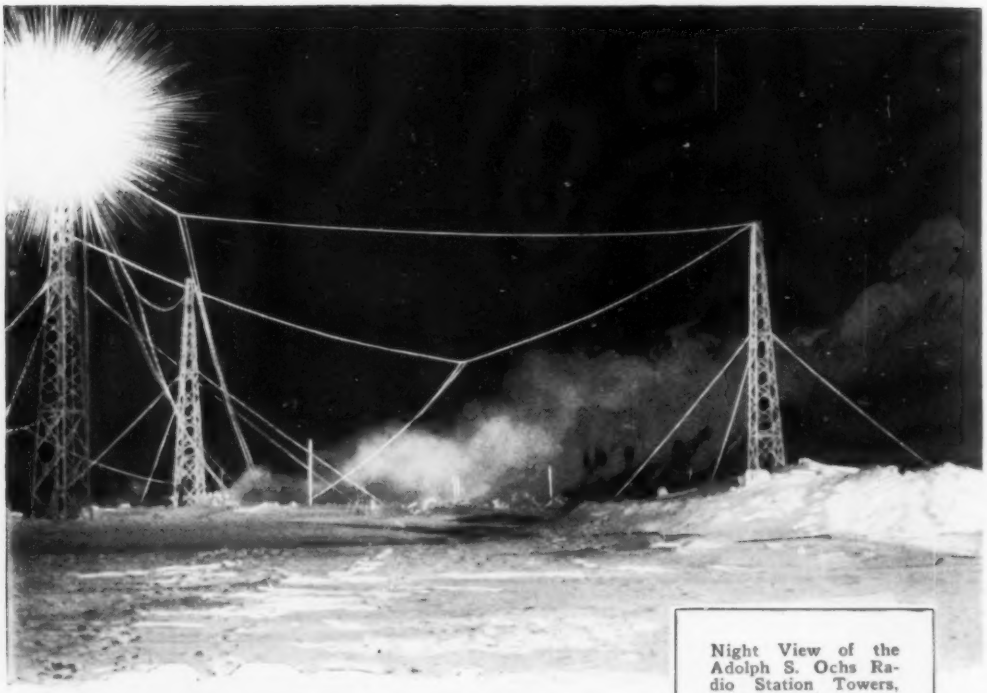


Warming Up the Engines of the Tri-Motored Ford Plane, the "Floyd Bennett," Which Carried Admiral Byrd and Companions over the South Pole; at Left, Captain Parker Standing in Hole Cut in Ice to Receive Water from the Photographic Laboratory, and, Below, Joe Rucker, Movie Cameraman, Making Film to Show Some of the Prize Beards Grown by Members of the Expedition; Boxing and Other Athletic Contests, Amateur Theatricals, Even to a Revue, the "Antarctic Follies," Lightened the Hours When the Men Were Confined to Camp by the Storms and Snows of the Far South

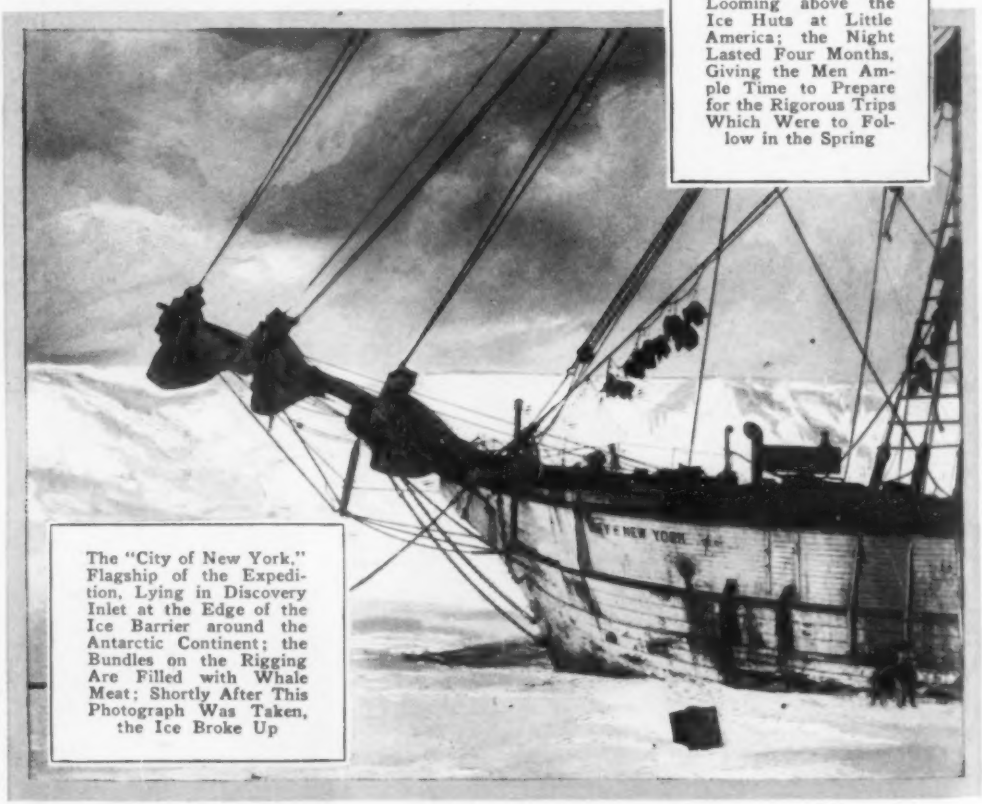
Above, Airplane View of "Pancake" Ice Floating in the Ross Sea; at Left, What the Well-Dressed Antarctic Explorer Wore—a Face Protector, Made like a Baseball Mask and Covered with Wind-Proof Material; Below, More Pressure Ice Piled in Jagged Heaps in the Bay of Whales Not Far from the Base Camp

A Conference of Pilots before the Flight over the South Pole; from Left to Right, Dean Smith, Capt. A. N. Parker, Admiral Byrd, Bernt Balchen and Harold I. June; Below, George Tennant, Cook, with a Captured Penquin; These Birds Were Curious and Tame But Not Satisfactory as Food

Below, Adm. Byrd Making Observations at Little America; the Flight over the South Pole Was But One of the Interesting and Important Accomplishments of the Expedition; Thousands of Square Miles of Territory Were Surveyed and Mountain Ranges and Other Geographical Features Were Located and Mapped; on One of the Geological Trips, Members of the Byrd Expedition Found a Cairn Built by the Late Roald Amundsen in 1912 While on His Way Back from the South Pole; on Another Trip, a 150-Mile Gale Wrecked One of the Airplanes



Night View of the Adolph S. Ochs Radio Station Towers, Looming above the Ice Huts at Little America; the Night Lasted Four Months, Giving the Men Ample Time to Prepare for the Rigorous Trips Which Were to Follow in the Spring



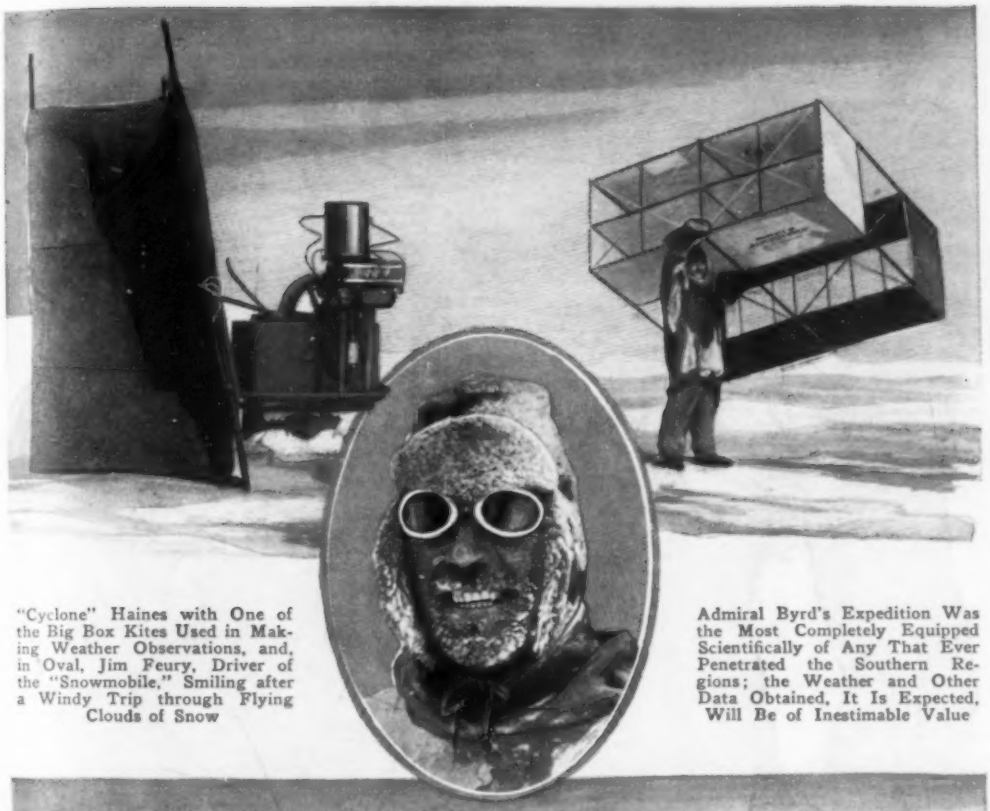
The "City of New York," Flagship of the Expedition, Lying in Discovery Inlet at the Edge of the Ice Barrier around the Antarctic Continent; the Bundles on the Rigging Are Filled with Whale Meat; Shortly After This Photograph Was Taken, the Ice Broke Up

At the Base Camp, a Few Members of the Expedition Enjoying a Game of Cards While Their Companions Look on from a Bunk; in Circle, Dean Smith, Left, and Harold June, Barbering

View of the Mess Hall Shortly Before Supplies Had Been Stowed Down for the Winter; the Flag Was Kept Flying as Long as the Sun Shone; Materials Were Carried by Dog and Tractor-Drawn Sledges from the Expedition Ship, the "City of New York"

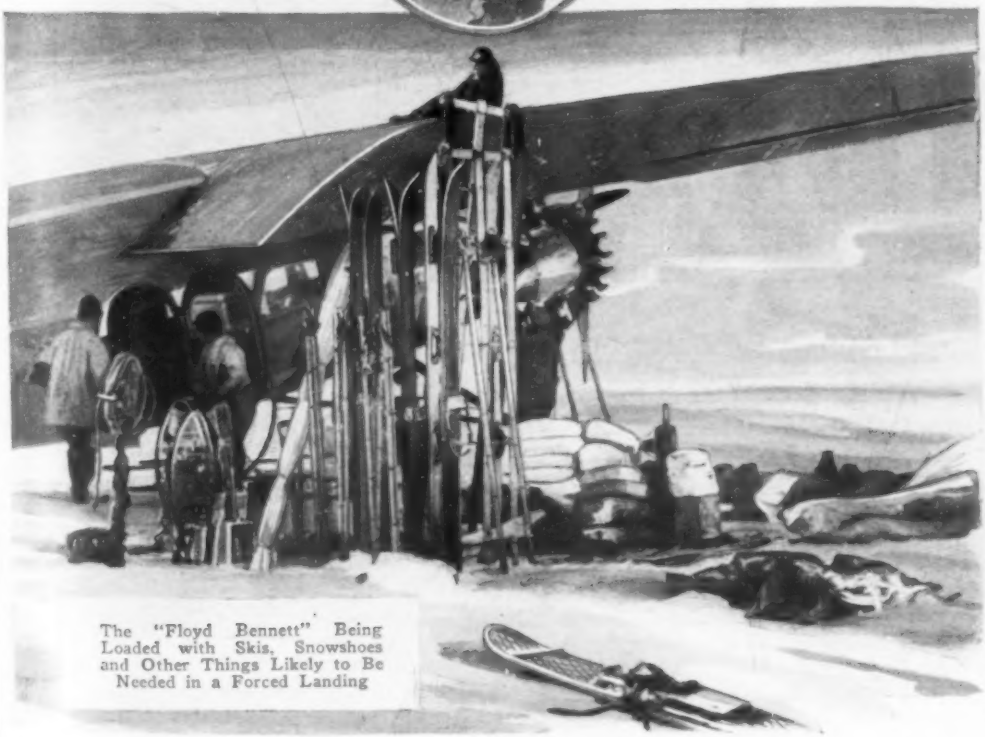
Running the "Snowmobile" Out of Its Winter Resting Place; It Was Completely Hidden by Snow and Ice When Spring Made Further Trips Possible; at Right, Howard Mason, Radio Operator, Who Was with Wilkins on Two Alaskan Trips

View from the "City of New York" Showing Dog Teams Loaded for Start to Base Camp



"Cyclone" Haines with One of the Big Box Kites Used in Making Weather Observations, and, in Oval, Jim Feury, Driver of the "Snowmobile," Smiling after a Windy Trip through Flying Clouds of Snow

Admiral Byrd's Expedition Was the Most Completely Equipped Scientifically of Any That Ever Penetrated the Southern Regions; the Weather and Other Data Obtained, It Is Expected, Will Be of Inestimable Value



The "Floyd Bennett" Being Loaded with Skis, Snowshoes and Other Things Likely to Be Needed in a Forced Landing

At Left, Capt. Ashley McKinley Sights Huge Aerial Camera on Human Tripod, and, in Oval, Another View of the Photographer and His Mighty Camera

Members of the Expedition Saluting the Flag, When It Was Raised the Day the Sun Returned after the Long Night at Little America

Above, Night View of Pressure Ice in the Bay of Whales; in Oval, Admiral Byrd with "Igloo," and, Below, Paul Siple, Boy Scout, with His Dogs

Left, Admiral Byrd at the Right, Watching Chris Braathem Completing Model of the "City of New York"; Below, Riding on Sleds behind the "Snowmobile," Left to Right, G. Hamilton Black, Jim Feury, Dean Smith and Paul Siple

Below, the Tri-Motored Plane "Floyd Bennett," Being Loaded with Gasoline and Other Supplies for the Flight over the South Pole; Byrd's Expedition Was a Special Victory for Aviation as Well as for Science, Skill and Courage

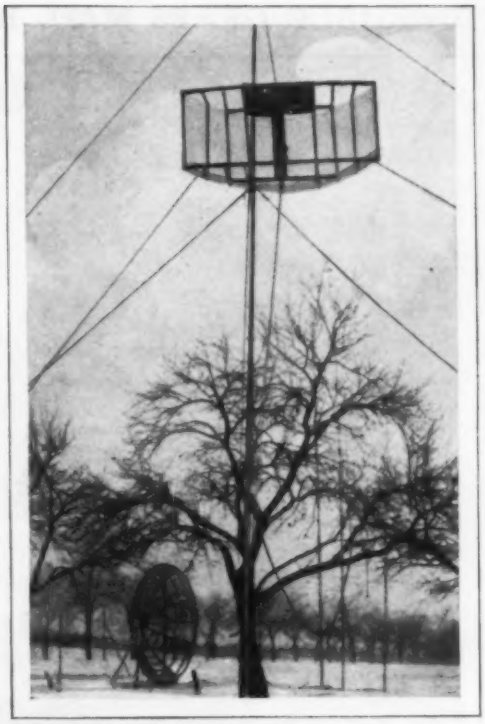
TELLTALE VAPOR OF PLANES TURNED INTO WATER

Army air-corps officials recently have been devoting considerable attention to trails of vapor noticed in the wake of pursuit planes during maneuvers. This phenomenon was particularly pronounced during high-altitude flights of about 28,000 feet in low temperatures and rarefied air, and was found to be the result of condensation of moisture from exhausts. The streak of vapor looks like the trail left by a sky-writing plane, and has been studied because such a streak, when multiplied by the presence of an entire squadron, renders the ships easily visible to anti-aircraft batteries on the ground and enemy planes in the sky. The remedy, however, was found to be quite simple—the installation of condensers on exhaust lines, similar to those in use on motors of dirigibles.

SINGLE-WHEELED AFRICAN TAXI RUN BY MAN POWER

While the automobile is used in the more developed parts of Angola, west Africa, the bush chair answers for taxi service in the more remote districts accessible only by rough trails. This vehicle, in its more luxurious form, consists of a rubber-tired wire wheel on which is mounted a light frame with a spring seat for the passenger directly over the wheel. Shafts fore and aft are for the two natives who propel the conveyance, one pulling and the other pushing.

Single-Wheeled Bush Chair with Double Shafts Used for Taxi Service in Parts of Africa Served Only by Rough Trails

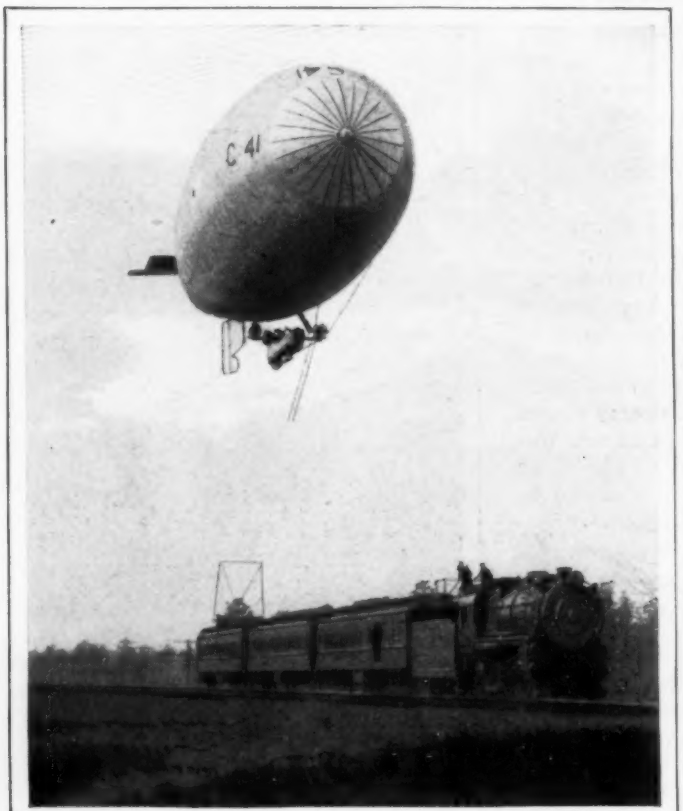


Cage Antenna for Ultra-Short-Wave Radio a Berlin Engineer Has Used for Transmission of Fog Signals

ULTRA-SHORT RADIO WAVES GUIDE SHIPS IN FOG

Fog signals, broadcast on ultra-short radio waves of twenty to 100 centimeters, would be more effective than lights, a Berlin engineer concludes after a series of experiments. The waves are readily concentrated in searchlight fashion, penetrating mists with but little absorption; they are of short range, require but little transmitting energy and are immune to atmospheric influences such as rain, snow and other factors that limit the usefulness of overhead conductors. The engineer believes that they might also be adapted to the use of police and fire-department units and where long distances are to be covered, a series of relay stations being used.

DIRIGIBLE GRABS MAIL BAG FROM SPEEDING TRAIN



Dirigible Taking Mail from Top of Moving Train with Grappling Hooks, Preparatory to Transferring the Pouch to a Ship at Sea

Transferring mail from a speeding train to a moving dirigible was successfully accomplished in recent tests near the naval air base at Lakehurst, N. J., to determine if it is feasible for an air carrier to take the mail from a train in motion and then transfer the pouch to a ship at sea. In the dirigible-train experiment, a portable platform was erected on the roof of the last coach of the train. Between two upright posts, holding the platform in position, was suspended a rubberized rope supporting the mail sack. The rope was tied to the posts in such manner as to be easily released by contact. Two men in the gondola of the dirigible carried long ropes to which were attached four-pronged grappling hooks. The men fished for the bag when the dirigible was brought in position over the train, finally making the pick-up after several unsuccessful attempts. It was found, however, that the bearing of atmospheric conditions on dependable operation makes it unlikely that such a service can be operated on a schedule basis. The operator of the blimp had difficulty in maintaining his ship on an even keel directly above the track while cruising at fifty-five miles an hour as the train below proceeded at thirty miles. When the dirigible was brought into position, its nose was tipped downward, and simultaneously the two fishermen made a grab at the sack with their hooks. The dirigible dropped the mail to a ship.

MOTOR CARRIED ON BACK RUNS TOOLS

Muscular power for operating hand tools, such as hedge trimmers, saws and borers, is replaced by a small electric motor worn on the back, which recently was tested successfully in Germany. The little motor provides sufficient energy to operate nearly any ordinary carpenter or garden tool.

Electric Motor, Worn on Back, Provides Power for Operating Small Garden or Hand Tools

Midget Cars Next?

An English Austin Tuned Up and Streamlined for Racing; It Hung Up a Class Lap Record of 63.62 Miles per Hour in a Tourist Race Held in Ireland

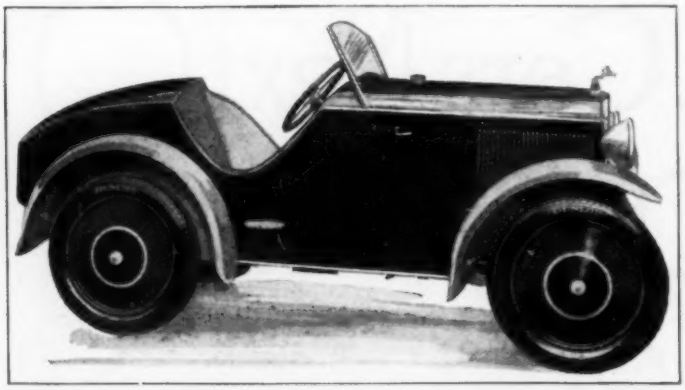
THE INTRODUCTION of midget cars in this country is a development which is being watched with intense interest by everybody—the public in general and automotive experts in particular.

Buyers are intrigued by the thought that soon a car may be available which will cost little or nothing to maintain and which can be bought for the small sum of $450 or perhaps less, fully equipped and fitted with a good-looking body.

With the ability to run forty miles or more on a gallon of fuel, having small tires (probably twenty-six by three and five-tenths), which cost only a few dollars, and possessing such small parts that repair expenses must be accordingly low, it is clear that all those who are interested in maximum economy will give such cars the closest consideration.

Following the growing popularity of midget cars in Europe, executives of American automobile companies have, during the past few years, given considerable thought to such cars and to the possible demand there might be for them in this country. One large company, at least, designed and built several cars of this type for experimental purposes. But in every case there was one fundamental question which troubled them: Will the American public buy these cars in sufficient quantity to make the venture worth while?

In this connection, it is interesting to note that years ago a number of midget cars were built in the United States and two of them were conspicuously successful, namely the first popular-priced four-cylinder Ford (1906) and the first Hupmobile (1909)—also a four. The Hupmobile and the Ford classed as midget cars with respect to wheelbase and weight, although their engines were considerably larger than any of the midget cars now built in Europe. The Hupmobile had a wheelbase of eighty-six inches, and a piston displacement of 112 cubic inches with cylinders of three-and-one-fourth-inch bore and a three-and-three-eighths-inch stroke. Originally it was built only as a roadster and sold for $750. The Ford had a wheelbase of eighty-four inches, weighed 700 pounds, and possessed an engine of three-and-three-fourths-inch bore by three-and-one-fourth-inch stroke, giving a piston displacement of 143.5 cubic inches. Its price was $500 and there was only a roadster model. Both cars were satisfactory according to the standards



Courtesy Agence Rol

The Rosengart Five-Horsepower Roadster, a French Version of the British Austin; Note the Thin Shell Radiator

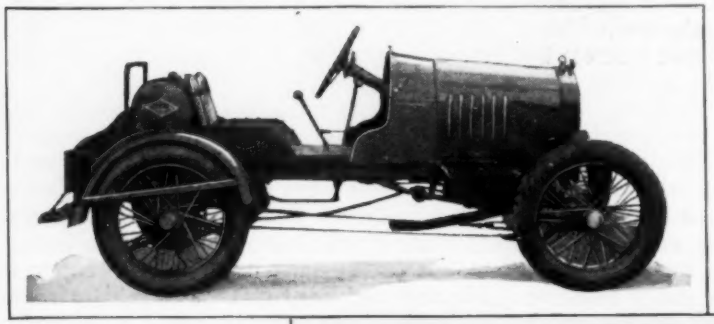
of that day, but as the years rolled by they were enlarged, principally, it is believed, to permit the fitting of five-passenger bodies.

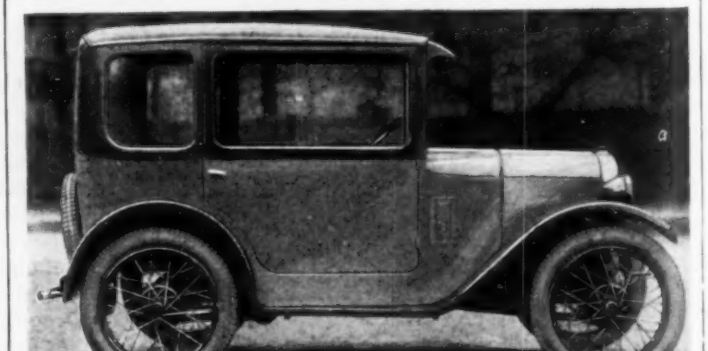
By comparison, the English Austin has a wheelbase of seventy-five inches, a four-cylinder engine with a bore and stroke of two and two-tenths by three inches, a piston displacement of forty-five cubic inches, and a weight of about 1,000 pounds. The term midget car, of course, is relative. But if it is assumed that any modern car with a piston displacement of sixty cubic inches or less may be so classed, then there are sixteen European midgets, with piston displacements ranging all the way from twenty-one to sixty cubic inches and with wheelbases varying from seventy-five to 108 inches. Weights of these cars average about 1,000 pounds.

With nearly a score of midget cars in Europe, the reader is certain to ask, why these cars are so popular across the ocean. Speaking of popularity, the Austin is the largest production job in England, and because of its success, it is also manufactured as the Rosengart in France and the Dixi in Germany—and, as already noted, the same car, with greatly improved appearance, is scheduled to go into production in this country.

The wide use of midget cars in Europe is due to several things: the greater cost of production in Europe; oppressively heavy motor-car taxes; high cost of fuel; lower wages, and high cost of insurance—in some cases.

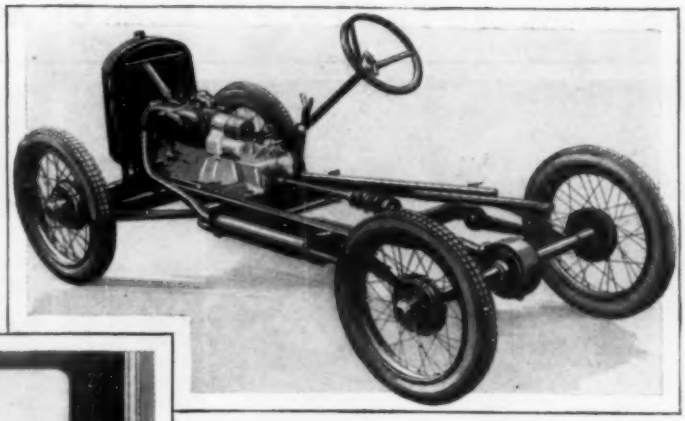
Due apparently to the less effective production methods in Europe, in order to build a car to sell for $500 to $1,000, it is nec-

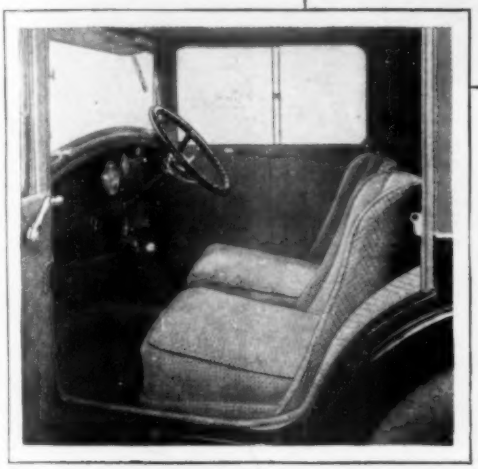




Another Midget-Racer Type and an English Austin Four-Passenger Model with Seven-Horsepower Motor; Note the Wide Door

essary to cut the size way down as compared to American standards. But even if this difficulty were removed completely, midget cars would still be in great demand because of the tax situation. In England, for example, the yearly tax is $2.55 for each square inch of area for all the pistons in the engine. Thus the yearly tax on a model-A Ford is $120, whereas the tax on a car as small as the Austin is a little less than $39, a yearly saving of $80 on taxing alone.





Chassis of the Tiny English Austin, and Interior of the Four-Passenger Coupe

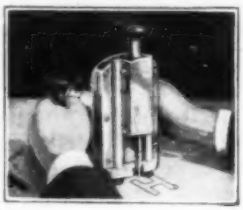
Now let us examine the midget car more closely from the standpoint of driver and passengers. To begin with, there is adequate room for a comfortable two-passenger body on these short-wheelbase cars—leg room, for instance, may be normal. Also, there may be space to seat two children and an adult behind the front seats, and in emergency two adults may find accommodation there. Riding quality is generally conceded to be satisfactory.

Maximum speed may be forty to fifty miles per hour, or more in some cases. While midget engines are necessarily small and the power they develop is moderate, say, ten horsepower, the wind resistance is also low, and it is this factor which particularly affects maximum speed. Disregarding technicalities, it is reasonably accurate to say that, at low road speeds, fuel consumption depends on car weight and engine size, and particularly on car weight. Thus it should be obvious that a car weighing 1,000 pounds should run twice as far on a gallon of fuel as one weighing 2,000 pounds or more.

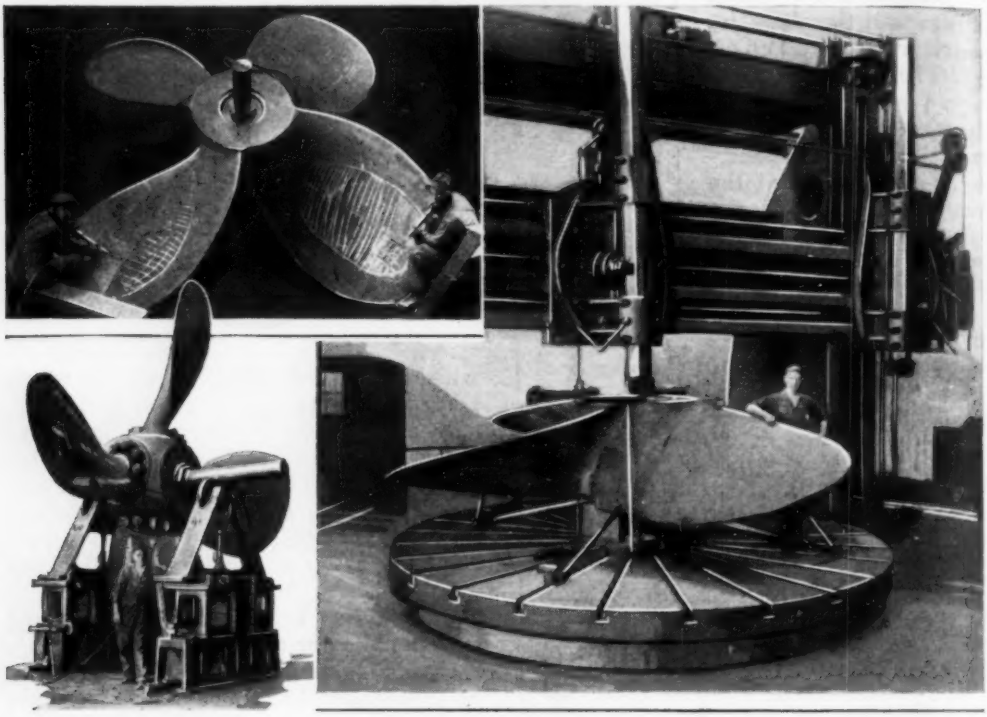
Other things being equal, a 1,000-pound car should steer about twice as easy as a 2,000-pound car, and the same ratio may be approximately applied to foot pressure required on clutch and brake. Gear shifting should be much easier, because of the comparative lightness of the clutch mechanism and the gears which rotate with it. In short, a midget car should handle with incomparable ease, a thing which will appeal to many. Finally, its short wheelbase permits it to be maneuvered and parked in places denied to larger cars.

MOTOR CUTTER MAKES LETTERS WITH BEVELED EDGES

Letters, fancy designs and stencils are cut from a wide variety of materials with a motor-driven unit that has five different cutters and an attachment for making beveled edges. The machine operates on paper, practically all kinds of synthetic lumber and thin metals as well as wood.



BALANCING THE PROPELLERS OF AN OCEAN GIANT



Courtesy Marine Engineering

Upper Left, Making Guide Lines on Propeller Blades for Chippers to Follow; Right, Boring Taper Hole in Hub of One-Piece Propeller; Lower Left, Testing for Static Balance

Special attention is given to the correct balancing of the propellers on battleships and other craft, for on their accuracy depends, in a large measure, the steadiness of the vessel, an important factor during gun fire. Balanced propellers are also important to commercial ships where safety, steadiness and a minimum of vibration are imperative. At the Boston navy yard, the big propellers' balance is carefully checked both while they are stationary and while revolving, although the latter method has been found impractical on the largest wheels, as they cannot be rotated sufficiently fast without the installation of huge and costly electric motors to furnish the power. In most cases, errors in the balance are due to unequal thickness of the blades or to unequal location of the blade centers around the hub. In a three-bladed propeller, for instance, the axes should be 120 degrees apart, but an off-center displacement of one degree would impose an unequal strain on the propeller, which would cause vibrations and possibly breakage. To balance a huge propeller for the "Leviathan," it was necessary to remove eighty pounds of metal from one blade and fifty pounds from another. The blades then had to be ground smooth and reheated.

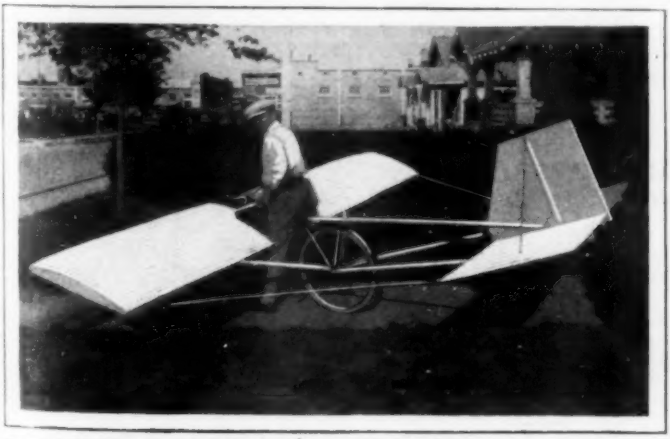
TEN THOUSAND MILES SAILED FOR A FISH

Owing to improvement in portable refrigeration plants, better design of deep-sea fishing craft and improved construction of fuel-oil tanks to permit a cruising range of 10,000 miles or more, the tuna fleet of San Diego and San Pedro, Calif., is this year voyaging 5,000 miles southward along the coast of Mexico and Central America in search of fish weighing from fifty to 350 pounds each. Now it is not unusual for a boat to make a trip of

from 8,000 to 10,000 miles and return with her below-decks refrigerators filled with 150 tons or more of fish worth six cents a pound to the fisherman. The boats have a yacht's bow, a freighter's midship section and a tug's low, flat stern, and are about 120 feet long. They carry 100 tons of live sardines in tanks on the stern, and the refrigerating plant keeps 125 to 175 tons of fish in perfect condition. Diesel engines drive the craft and fuel-oil tanks hold a two months' supply. While the best tuna fish have always been found off the tropical coasts, fishing boats until recently were unable to bring them back in good condition from distances greater than 1,000 miles from the packing plants. Excepting whalers, these boats make the longest fishing voyages in the world.

BICYCLE WITH GLIDER WINGS GIVES THRILL OF FLYING

Some of the thrills of flying have been obtained by the owner of a bicycle who has equipped his vehicle with a set of wings and a tail. The lift on the wings and the down pressure on the tail combine to lift the front wheel when the machine is in forward motion, the rear wheel remaining on the ground for traction. Lateral control of the wings is combined with the control of the front wheel, and the arrangement of the tail keeps the wheel at a uniform height above the ground. Wings and tail are quickly detached whenever the rider wants to use the bicycle in the ordinary way.



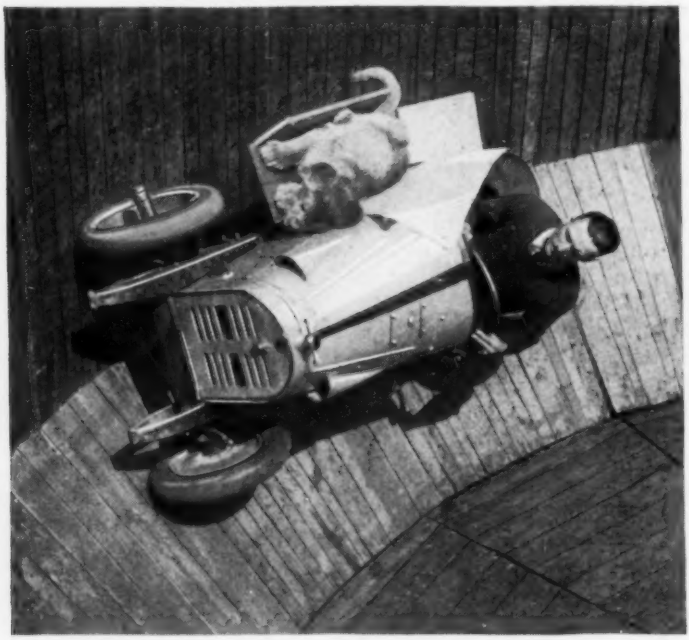
Bicycle Equipped with Glider Wings and a Tail; the Wings Lift the Front Wheels off the Ground When the Wheel Is in Motion

Auto Containing Equipment for Locating Source of Radio Interference; Note the Rod Antenna

RADIO TROUBLE HUNTER IN CAR ENDS INTERFERENCE

Finding causes of radio interference on power lines is simplified with a portable locator which can be operated from an automobile or carried about suspected points suspended from the shoulder. The trouble hunter consists of a four-tube combination radio and audio instrument, self-contained with A and B-batteries, an ordinary headset, a loop with socket for the ceiling of the auto, a smaller loop for use outside the vehicle, a base if the loop is to be used in the ordinary manner, and a rod antenna in four sections for attachment to the roof of the car. One man in an auto is able to patrol suspected lines and locate extremely slight leaks or noise sources.

¶Canned salmon contains a substance which prevents pellagra.



Racing Car Speeding around the Almost Perpendicular Wall of a Motordrome Track with an Unleashed Lion Cub as a Passenger

RACING CAR CARRIES LION CUB AS EXTRA PASSENGER

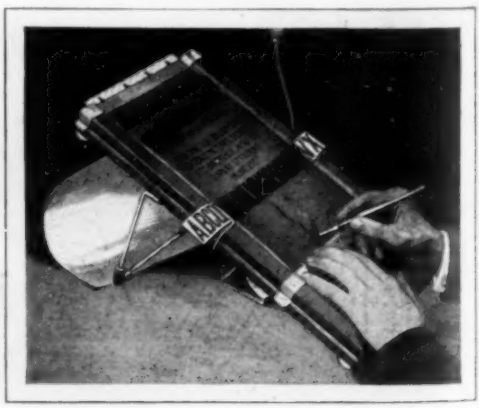
Driving at eighty miles an hour around the almost perpendicular wall of a motordrome track with an unleashed lion as a passenger is one auto racer's idea of affording an extra thrill for spectators. The driver takes as an added passenger a five-months-old lion cub which crouches in a frame built on the side of the car. The most difficult part of the remarkable stunt is to induce the lion to remain quiet throughout the wild ride, as a move on the part of the animal might be disastrous to both occupants of the car.

SCREWS ARE HELD IN GLASS BY FIBER PLUG

Plugs made from stiffened jute fiber in various sizes and lengths now are available for fastening screws in any kind of material, including glass, metal or plaster. When the screw enters the plug, the jute fiber expands in all directions, compressing against the sides of the hole in the metal or glass. The hole, plug and screw diameter are the same, thus threading the plug automatically when the screw is inserted, and permitting removal and replacement of the screw. The hole for the plug in glass or tile is first made with a star or twist drill. The plugs make it unnecessary to tap holes in metal, glass or tile, for screws, and thus prevent chipping the materials.

STENCIL TRACING IS MADE EASY BY FRAME

Tracing pictures, drawings, music or display lettering on dry stencils for reproduction on a duplicating machine is simplified with a stencil-tracing frame containing a light underneath to make drawing easy. It consists of two pieces of framed glass, about three-quarters of an inch apart, with openings at top and air holes at the bottom to create a draft, thus protecting the celluloid writing plate and stencil from the heat of the electric light beneath the lower glass plate. A metal cross plate at the top permits insertion of any form of stencil-backing sheet in any desired position, and the frame may be adjusted to any desired angle. Spring-wire clamp gauges are provided for holding letter and numeral strips in position.

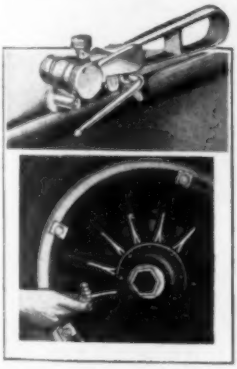


Stencil-Tracing Frame Consisting of Two Plates of Glass with a Light Bulb Beneath Them

SUGAR PRODUCED FROM MILK USED IN MAKING CANDY

Successful experiments by the department of agriculture with milk sugar and cane sirup in making candy, presage the opening of a new door for utilization of the surplus of these agricultural products. Milk sugar, technically known as lactose, accounts for about five per cent of the weight of whole milk, and at present is produced commercially in limited quantities only. It is obtained from milk whey, and until the recent discovery of a new process for extracting it, has had a high production cost. Its successful use in making candy, along with utilization of cane sirup for the same purpose, may make a market for all the surplus of both products. Experiments also are being conducted in the use of honey for candy, particularly to determine some method which will prevent it from turning dark when heated, and to find whether all kinds of honey have this tendency.

ROTARY PAINT STRIPER ROLLS LINES ON AUTOMOBILES



Painting decorative striping on automobiles now may be done quickly and easily by the novice with a rotary striper, a precision tool consisting essentially of a wheel, revolving in color, or striping material, which rolls the stripes in any desired pattern. The apparatus is equipped with a trigger which automatically starts and shuts off the flow of color, and an adjustable guide which can be set in any position to follow beads, molding, window or door edges. Guides of different shapes and wheels in different widths give a variety of patterns.

¶One of the navy's first wrought-iron ships, the "Wolverine," launched eighty-seven years ago, still is in service as a training ship.

Ancient Astrolabe, Superseded by Sextant, for Computing Latitude and Longitude

ASTROLABE TELLS TIME OF DAY AND POSITION FROM SUN

Latitude, longitude and the time of day all are told accurately by peering at the sun through an ancient astrolabe, now owned by the Adler planetarium at Chicago. The instrument, made in England in 1500 and still workable, was used for observing the position of heavenly bodies quite generally until it was superseded by the sextant for computing latitude and longitude.

NEW WAY TO RESEAT VALVES SAVES MUCH TIME

Renewing valve seats has been greatly simplified by a system recently patented. The seating is formed by cutting away the old one and undercutting the bottom of the recess thus formed. Into the recess is pressed a collar of cast iron, around whose base is a rim projecting downward which is forced into the undercut portion. The ring is thus prevented from moving, and a new seat is cut around the top edge. In this manner all valve seats can be renewed in a few hours.

Why People are

An Ancient and a Modern Talisman of Good Luck; during the Thirteenth Century the "Lee Penny," the Medical Token Illustrated at the Left, Was Believed to Have Magic Curative Properties and Was Widely Used by the Afflicted; Below, the Person Who Finds a Horseshoe, Even in This Age of Automobiles and Airplanes, Still Is Considered Lucky, and This Superstition Probably Arose Because the Shoe Is Shaped Like the Doors of Homes That Were Built Thousands of Years Ago

By KENNETH B. MURRAY

DO YOU have a little "jinx" in your home—do you knock on wood or hang a horseshoe over the door? Well, you needn't feel exclusive, because everybody does it, although few know why they are doing it.

Let's go back several thousand years in imagination to ancient Egypt. The priests wrote: "Death and calamity to anyone who dares despoil the royal grave, or remove from it the precious stones and metal." This kept the superstitious natives away but left the priests to plunder at their leisure. Evidence of this has been found in a number of graves opened by expeditions from the British Museum. The tombs were found intact and undisturbed as they had been at the day of burial but inside there was indisputable evidence that the priests had been there first, and all that was left for the excavators of the present day was a dry mummy.

In the year 1889, five members of the British Museum staff located and opened, in the Valley of the Kings, the sarcophagus of one Priestess Amen-Ra. Afterward all five of the party died at natural intervals. Also, the men who transported the mummy to England, the official photographer, the translator, and a servant in the museum employ, met with various disasters and accidents. In the natural order of things this would pass as nothing unusual, but some superstitious folk seized on the incidents as a result of the curse. So when King Tut's tomb was discovered the precedent was remembered and the credulous searched for incidents that could be taken for disasters in the lives of members of the party. They would have been just as successful had they chosen to watch for calamities in the lives of any other public men.

Do you knock on wood, and know why you do so? Are you superstitious of the number thirteen and Fridays? Do you believe that a horseshoe or crossing your fingers maintains and brings you "good luck"?

Many of these superstitions have been

Superstitious

carried from Biblical times. Knocking on wood became a superstition when an ancient conceived the similarity between it and knocking on the Cross (of wood). Some cross their fingers for the very same reason. Others believe that the number thirteen is unlucky because that number sat at the Last Supper and the first to arise was crucified. Friday was the day of the Crucifixion. These are incidents of Christian history, but why anyone should seize on them as signs of "bad luck" is not easily understood. Having no basis in fact, it is labeled a superstition, meaning something that we do not understand, or on which we lack education.

Until recent years, steamships never set out on a voyage on Friday. In various countries of Europe, the unlucky day is designated as Monday or Friday, according to the country. Several years ago, an Englishman came to our shores and was surprised to learn that Friday was our hoodoo day. His was Monday. He finally compromised on setting aside both Monday and Friday as days on which to be especially careful.

Thirteen on Auto-License Plate; Skull Used in Mystic Rites, and Ancient Hebrew Talisman, Supposed to Bring Success in Business

Steamships, hotels and Pullmans have difficulty in getting customers to overlook the number thirteen on room, compartment and car doors. Recently the state of California announced that it was swamped with requests from prospective auto-license purchasers not to send them plates bearing the number 13. On the other hand, thirteen men in New York formed the Thirteen club, and met on the thirteenth of each month, at 7:13 o'clock. A courageous bit of daring when there is so much "bad luck" floating about!

Thousands of years ago it was a reli-

Friday the Thirteenth, Considered Doubly Unlucky Because Thirteen Were Seated at the Last Supper, and Friday Was the Day of Crucifixion

gious practice to paint the doorways of each house with the blood of sheep. The doorways were all arched. Gradually the practice came to be a means of keeping "bad spirits" out of the house. Then the similarity between the shape of the door and a horseshoe was noticed. Thereafter horseshoes became "lucky."

Astronomy is but one of the sciences that has suffered the burden of being seized, as a pseudo-science, for the purposes of astrology. The heavens were divided into twelve parts, each with a particular "sign." Each sign is represented by a different meaning. To be born in the month covered by the sign of the lion, one will surely be courageous in life, so the astrologers say. And to be born under the sign of the crab is to be backward, in the manner in which the crab travels. The only difficulty presented is that, in fortune telling by astrology, the information given is a generalization designed to cover most any person.

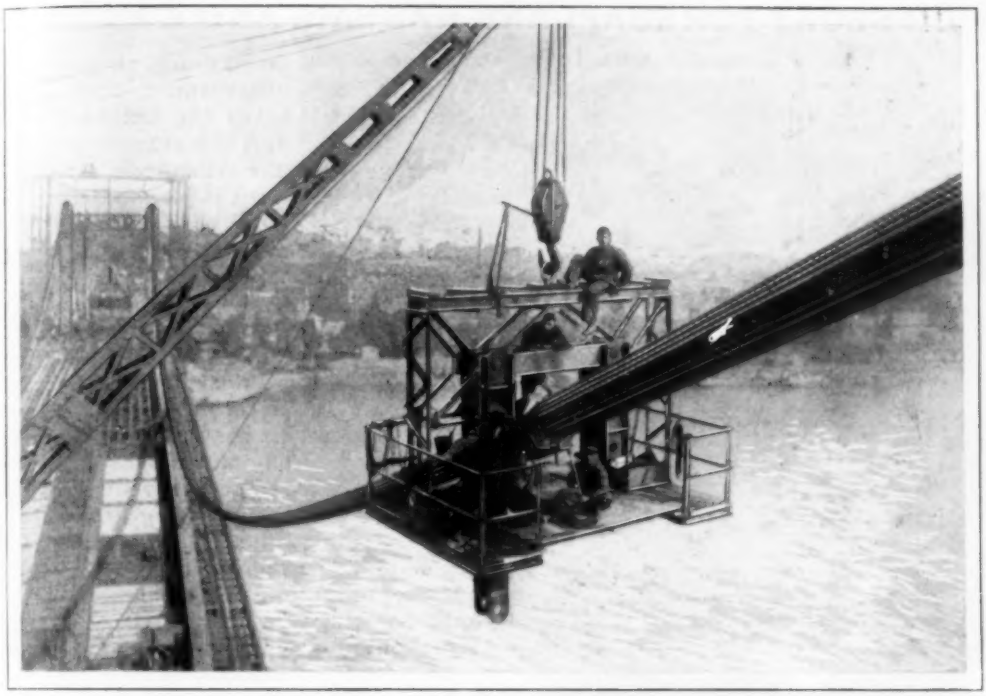
In the same manner, the moon comes in for its part in a number of superstitions. Perceiving that the moon exerts a certain drawing power on the earth, in that it causes tides, the superstitious find the new moon a most propitious time for planting, so that "as the moon grows in size so will that which is planted." For the same reason the natives in Cuba are superstitious about walking or sleeping in the moonlight, believing that it will draw their faces to one side while it is waxing, or cause depression of the features when it is on the wane.

The magic talisman has had its part even in our own modern life. The talisman first originated through strange religious beliefs, but the years and addition of ideas of each generation have contributed their dues, and today a talisman may be obtained for the cure of almost any disease.

ELECTRIC MODEL PLANE FLIES AND LANDS ITSELF

Electrically operated miniature planes that really fly and make three-point landings have appeared. They are connected to a model hangar by a steel-spring rod. Current, obtained from the lighting socket and put through a transformer, passes through the spring rod as one side of the circuit and through a separate wire down the rod to the tip of the wings as the other side, to operate the tiny motor and revolve the propeller. When the current is shut off, the ship makes a graceful three-point landing. It requires about fourteen volts to take off and is operated on approximately eight volts. The plane has inside lights. To accompany the model, a landing field with hangars, border lights and a tiny beacon with a revolving light may be obtained.

Model Electric Plane and Hangars, Showing Flexible Wire That Holds Plane as It Flies in Circle



Aerial Workshop Suspended from a Crane to Allow Workmen to Attach Clamps to Sections of a Bridge Cable; the Shop Was Complete in Every Detail with Modern Tools and Equipment

BRIDGE WORKERS' AERIAL SHOP SUSPENDED FROM CRANE

Cable workers on a German suspension bridge recently enjoyed the novelty of an aerial workshop. When the cables were placed to support the suspension bridge over the Rhine river between Cologne and Muelheim, it was found necessary to bind them at various points with sleeves or clamps. To accomplish this task, a platform for the workers was suspended from a crane. The clamps are attached under a pressure of 300 tons or more, so that a complete shop with many workmen must be available, and this fact made necessary the workshop in the air.

GAS MANTLES ARE RADIOACTIVE

Common gas mantles such as used in portable gasoline lanterns become radioactive when allowed to remain unused for several years. The mantles contain a compound of the metal thorium, which is not radioactive and does not emit penetrating rays like its decomposition products. However, when the mantle remains unused for seven or eight years, there is formed a new compound, mesothorium, which is many times as active as radium and constantly sends off small particles and invisible waves.

SANITARY ASH-TRAY RECEIVER DISCARDED WHEN FILLED

Disposing of cigar and cigaret ashes is made easy by a sanitary ash tray with a removable receptacle which is discarded when filled and a new receiver inserted in the tray. The refills are inexpensive and have properties which neutralize tobacco odors, while a sliding lid in the top of the tray prevents smoke. The tray is all metal and may be obtained in various colors, while the top is of stainless steel.

LIFEBOAT FOR SEAPLANE HAS SAIL AND A MOTOR

Unsinkable Lifeboat for Aircraft Equipped with Outboard Motor and Sail; Above, Glass-Inclosed Lookout Turret Set in the Deck

To enable a pilot on a transoceanic flight to remain afloat and eventually reach shore after a crash at sea, an unsinkable "kayak," or lifeboat for aircraft, is equipped with both a sail and two outboard motors. During a storm, the craft can be closed watertight, the occupants being afforded a view in all directions from a hexagonal, glass-inclosed lookout turret set in the deck. The canoe itself carries three persons, and inside there is storage space for folding rubber boats which it can tow, so that more than thirty persons may be accommodated in an emergency. The craft is equipped with oars as well as sails and motors and can be steered from inside. In a test trip, the inventor made a nine-day voyage from the Faroe islands to Bergen, Norway. Off the Norwegian coast the boat encountered an eight-ton whale and was disabled, drifting helplessly for three days until fishermen sighted it. The whale made a dive for some refuse thrown overboard, and in so doing, smashed the glass turret and took away the outboard motor. An attempt to cross the Atlantic in a similar craft is planned.

LAMP OF THREE COLORS GUARDS RAIL WORKERS

Devised especially for workers in railroad yards, a carbide signal lantern now on the market has a light at the rear as well as a strong white light in front. The rear light may be changed to red or green by means of a locking device that insures against an accidental change of the color. The red light plainly tells the engineer or motorman that a man is in the yards, or it may be used to replace a yard signal out of order.

ADS ARE WRITTEN IN WATER ON CITY SIDEWALKS

Advertising slogans are written with water on sidewalks in Barcelona, Spain, with the aid of a portable machine that inscribes the characters from a stencil arrangement in a revolving drum and water container pushed along by the operator. The letters are plainly visible, as the space they occupy is left dry while the border around them is moistened and hence changes color.

Temporary Sidewalk Sign Written in Water; the Letters Are Dry, and Space about Them Is Wet

BONE-DRY WALLS TO KEEP OUT DAMPNESS

Special methods of construction were employed recently to make a Galveston, Tex., hospital entirely moisture-proof. Because of its location, the city is damp, and making a building bone-dry required special treatment of foundation, walls and roof. Membrane waterproofing, marine cement, damp-resisting paint, plastic waterproofing and a dehydration solution, all were utilized. The membrane waterproofing, consisting of several layers of asphalt-saturated and coated felt, was employed from the foundation up to the first floor, but before this was applied, the surfaces so protected were covered with a cold binder sprayed on with air under pressure. A tar compound was sprayed on the underside of all concrete beams, slabs, joists and girders on the ground floor, and the dehydration solution was applied to the masonry walls, inside and outside, to seal the pores of the stone and brickwork.

Children on Horseback Engaged in Doughnut-Eating Race; the Doughnuts, Suspended from Strings, Cannot Be Touched with the Hands

DOUGHNUT-EATING CONTEST FOR YOUNG RIDERS

Modern variation of the Hallowe'en game of apple bobbing was provided recently at Pinehurst, N. C., where the children, mounted on horseback, engaged in a doughnut-eating contest. The doughnuts were suspended from strings and the children, approaching them on their mounts, endeavored to devour the doughnuts without touching them with their hands by catching the rings between their teeth after moving the horses into position.

MOVING BRUSHES OF DOORMAT CLEAN IT AUTOMATICALLY

Sanitary doormats that clean themselves are equipped with movable brushes instead of the ordinary fiber that allows dirt to settle in it. The mat consists of a frame in which is placed a grate on which the brushes rest. When trod on, the brushes move alternately, causing a friction between them that shakes the dirt loose, allowing it to fall through the grate and into the mat holder. Mat and grate can be removed to empty the dirt at intervals, and sections of the brushes may be replaced when worn.

TEST PLUG FOR WATER PIPES HELPS IN BACKFILLING

To determine whether sections of a water main are tight as the pipe is being laid, a test and puddle plug now is available which also is a help in backfilling the trench. The plug is inserted in the end of the pipe and water pressure is applied for testing the joints. Dirt is then dumped in the trench a few feet behind the end of the pipe to form a dam. On the test plug is a two-inch coupling to which a hose is connected and the trench flooded.

Spring Tester in Position, to Record on a Penciled Graph the Riding Qualities of This Car

AUTO'S RIDING QUALITY SHOWN BY SPRING TESTER

Riding qualities of an automobile are accurately shown on a penciled graph by the use of a precision apparatus which automatically indicates the action of springs, shock absorbers, tires and axles. The car is placed on a smooth floor and the recorder stand is set close to the fender at the wheel to be tested, a pencil being attached to the fender by a clamp, and a graph sheet placed in position on a recording drum which the pencil touches. The car is raised to a given height by an electrically driven jack, and the jack is released suddenly after the revolving drum has been started. The drop causes the springs to compress and recover, and all vertical motions are recorded on the chart along with their duration to hundredths of a second. Each wheel is tested separately, then the two rear wheels simultaneously, and the two front wheels together. The recording pencil also may be attached to the hub to give readings covering axle, tire and wheel movement, thus affording an accurate picture of the shock-absorbing qualities of the car and indicating the adjustments necessary.

NO CHURNING MAKING BUTTER BY CENTRIFUGAL PROCESS

Butter can be made without churning by using centrifugal equipment which has the additional advantage of being continuous and not coming in contact with human hands. The apparatus first was used for making high-grade cream of from seventy to eighty per cent butter fat to cut the shipping bulk of this product by about half. Modifications then were made incorporating the processes of pasteurization, culturing, coloring, washing, salting and working the butter. After obtaining a high fat content, it was found to be a simple process to knead the butter and dispel the buttermilk with the apparatus, which is to be sold at a reasonable cost.

TUBE-FORM FIRE EXTINGUISHER FOR HOME AND AUTO

Resembling an overgrown tube of shaving cream, a chemical fire extinguisher now is available for the home or automobile. To operate it, a cap is removed from the top and a hole punched in the soft nozzle with a pick accompanying it. Turning a key at the flat end forces the liquid through the nozzle in a fine spray. The tube extinguisher costs little more than a refill for the ordinary cylindrical kind.

Chemical Fire Extinguisher Operated Like a Tube of Shaving Cream

BLACK RASPBERRY GROWS WILD AND RESISTS DROUTH

Fruit growers are interested in a wild variety of black raspberry which was found in the Oregon woods. It thrived during a hot, dry season when domestic kinds languished, did not die down in winter and even produced berries in the late fall. It is believed the specimen is a hybrid of the black raspberry with some species of blackberry. Its leaves and growing habits are much the same as those of the latter. Experts are examining the fruit to determine if it is suited to commercial shipping and canning.

MULTI-COLOR AIRBRUSH PAINTS THREE SHADES AT ONCE

Applying one, two, three or more colors in the same time previously required to paint one, a multi-color airbrush controls each color independently so that all may be applied simultaneously, or shut off at will. Perfect control is offered from the finest line to the widest spray, and multiple heads in forty combinations provide a wide coating range. It may be used as a single unit or expanded into gang units of any number of brushes for manual or air operation. Pressure feed tanks can be employed when a greater finishing speed is desired.

REMEDY FOR CABBAGE DISEASE

Hydrated lime, one of the commonest and cheapest chemicals, has proved an effective remedy for clubroot of cabbage, one of the most serious diseases of this truck crop. While other forms of lime are ineffective, hydrated lime, applied two tons to the acre, keeps the disease in check. Clubroot is caused by a primitive organism belonging to a class known as slime-molds, a group so far down the evolutionary scale that it is uncertain whether the creatures are plants or animals.

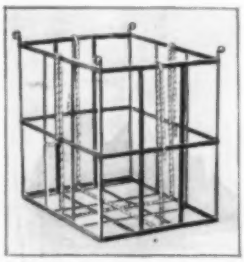
Artificial Angleworms That Wriggle on the Hook Have Proved Attractive Bait

ARTIFICIAL ANGLEWORM BAIT COMES BY YARD

Fishermen who prefer angleworm bait, but are unable to procure them, now may use artificial worms to deceive the fish. The artificial bait comes in three-foot lengths, and the angler may cut it to whatever size he believes will best attract his quarry. When on the hook, the bait bears a remarkable resemblance to a wriggling worm.

BALER FOR OLD NEWSPAPERS SIMPLIFIES TYING

Old newspapers are easily baled and tied in a simple rack that keeps them in a neat pile and is so adjusted that the strings are already in place as the bundle is built up, thus saving the work of handling a cumbersome and heavy pile when the papers are ready for disposal. The baler is strong and neat, easily moved about and will last indefinitely.



Battling through a Thunderstorm; Vicious Wind Currents and Not So Much Lightning Constitute the Chief Worry Here, and Wise Pilots Always Try to Avoid a Storm Area of This Kind

Hell Stretch

Queensboro Bridge Looming Up through Clouds That Shroud Most of New York City; a Hole in the Fog like This Is Always a Welcome Sight to the Pilot Seeking a Landing

By JAMES W. BOOTH

TO LOVERS of outdoors the mountains between Bellefonte and Aaronsburg, Pa., are numbered among the masterpieces of nature, but pilots of the air mail have christened them the "Hell Stretch," for they are a barrier that marks the most treacherous flying conditions to be found anywhere in the United States.

Still, day and night, over that stretch, heavily loaded planes, bearing mail and express, plow along. A corps of the most expert pilots in the country—and the most daring—is on the job to see to it that the mail goes through.

The percentage of fatal forced landings and crashes, to be sure, is small compared with the total number of such landings and accidents, and in the repair base at Chicago, they can show you hundreds of bent and twisted steel propellers from ships that have made bad landings or difficult take-offs without fatal results. All of which points to one fact, aviation men say: The odds are heavily in favor of the pilot going through, and of his living in a crack-up even if it occurs along the Hell Stretch.

The question may arise, why Pennsylvania's mountains are so treacherous? Why are they regarded as the worst country in the United States to fly over?

It is because these mountains are unlike any others in the land. They are not extraordinarily high, few ranges going over 3,000 feet, but there are miles of heavily wooded hills. The air route is dotted with emergency landing fields, but to the left and right of the course, the hills and forests offer small opportunity for landing a plane safely—especially if that landing must be made in the inky blackness of the night or the impenetrable fogs that cuddle close to the ground.

In the west, the mountains are not so

heavily wooded. Instead of peaks, the Alleghenies are a series of ridges that rise one a few feet higher than the other with narrow valleys between—not open valleys as is the case in the Rockies and Sierras. On all but fair days and nights, the clouds usually hang low over the mountain tops and the valleys are dark with fog. And low-hanging clouds and fog are the airman's worst foes over rugged country.

The mountains have no flat, clear tablelands at their summits to afford any sort of landing place for a disabled plane. Their tops and sides are either densely wooded or bare stone. As a rule, western pilots fly over wilder territory than do the pilots on the eastern routes, yet it once took Harry A. Smith, chief test pilot of the Bellanca company, two days to find his way out of the Pennsylvania mountains after a forced landing. "I saw no less than two hundred wild deer in the woods," he said. "Some came so close I could have knocked them over with rocks. They were just curious."

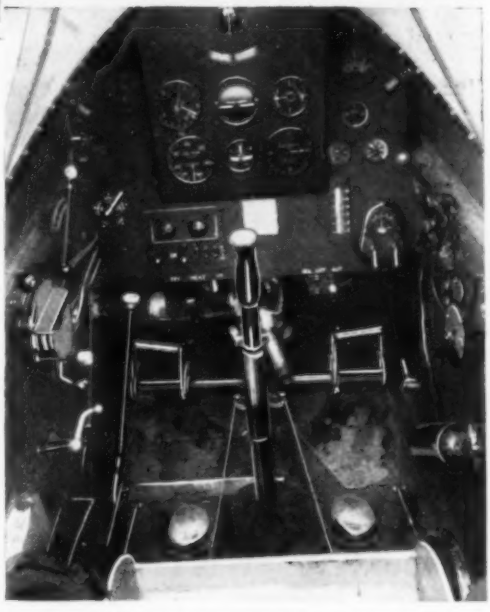
In the spring and summer, violent rain and electrical storms afflict this region, rising sometimes without notice. In the fall and winter, fog and haze lie low over the mountain tops, shrouding the wooded ranges from the eye of the pilot. And sometimes unexpected wedge-shaped snow and sleet storms beat down from the lake country and strike the route. The mountains are continually snowbound in the winter.

Flight over such a territory as the "graveyard stretch" by day is a job that's hard enough. But supplant whatever visibility the day flyer may have by total darkness, and add a blinding snow or sleet storm to the cold, and you've got a real task for the pilot.

Just below thirty-two degrees Fahrenheit, the mist in the air, or the snow, or the sleet, begins to gather on the wires, struts, wings and tail group, and hurtling through the air at better than a hundred miles an hour packs that formation into ice on the plane. Ice is heavy. The pilot may seek a higher altitude in an attempt to find a colder or warmer stratum to prevent the formation. If he is barging along "hopping the hedges," skimming the tree tops in an effort to catch the gleam of the marker beacons or danger lights on the higher elevations, he can't go lower and get rid of that ice. And when the ice reaches a certain weight, he can't climb, especially if it has formed in such a way as to change the wing curve of his plane and automatically reduce the lift.

Given a set of circumstances like those,

Zero Weather Doesn't Halt the Air Mail: Scene at Chicago Airport during Extreme Cold Weather Last Winter; Planes Being Warmed Up for a Night Flight to New York



Unloading the Night Air Mail, and Interior of Cockpit of N. A. T. Plane, Showing Numerous Controls and Instruments

by no means uncommon, and you have danger. It's not very often the big motors quit anymore. It's not very often the big Boeing, Curtiss or Douglas ships come to grief through failure of even the smallest part. But when ice forms on the wings of a ship mushing along over the tree tops and the pilot can't get rid of it or climb, he's got to come down. That's when the rugged topography of the Hell Stretch or the rest of the mountainous country takes sides against the skill of the stout-hearted man at the controls. The heavy ship comes down, but where and how?

In a storm or fog, the pilot flies "blind," that is, he pays attention to nothing except the instruments on the board in the cockpit. Perhaps the compass before him goes "haywire," and he has lost his course. Cruising in the sky surrounded by fog that obscures even the stars from his sight, the pilot loses faith in his other instruments, as some pilots have done, and decides to trust to his fanciful instinct. He flies on to some point where he believes there is a pass in the mountains but crashes into the mountainside, as many have done.

Paul Collins, veteran pilot of the New York-Cleveland run, had better luck on Hell Stretch than some of his fellow airmen. One cold, gray morning, he leaped into his mail plane at Cleveland, gave his engine the "gun" and went roaring into

At the End of a Flight, the Pilot Submits a Check Sheet on Which Are Noted Any Details for Special Inspection or Repair

the murky east. The half-light of day was over the flying field. Bad weather was sensed in the murky offing.

Over northwestern Pennsylvania, Collins struck it. A line squall rose out of the storm, ripped into his plane, smashed off a wing and forced him, after terrible moments of bucking and fighting, to abandon it for a parachute.

Four thousand feet up, at the mercy of the storm, Collins flipped open his safety belt, caught a strut of the remaining wing and swung out into space. He rocked perilously in the sky for a few moments and then, free from his falling craft a second, he let go. Tossed like a leaf in the swirling eddies and fierce currents of the upper air, the flyer gave himself up for lost as his silken savior swung to and fro. Then, true to the faith built into it, the great half arc opened right side up to the steadying weight of his body below, and floated safely to earth on the wooded countryside of Pennsylvania, near Millstone.

Thomas P. Nelson, flying east with the night mail, got the breaks on November 6, last. Soon after he passed the intermediate landing field at Ringtown, Pa., he noticed that his ship was on fire. He immediately turned back toward the field and began to fight the fire—shutting off his gas, turning on the fire extinguisher. But the fire extinguisher had frozen.

There was only one thing to do—take to the parachute. But before doing so, Nelson safely guided his blazing craft away from the field and the town toward the open wilderness, where no one could be injured by the crash of the ship. Then he floated safely to land. He got the breaks that time, but the jinx of the graveyard stretch got him in the end. A month later, a fierce winter storm proved too much for him and he was found dead beside his plane, near Cleveland.

The list of those who have died on Hell Stretch is growing more slowly these days of better instruments, better ships, finer motors and radio than it did in the past. Many expensive tests are being made in an effort to bring the flyers nearer to the goal of positive safety. More expensive equipment is bought and installed. A huge corps of experts is employed continually by the N. A. T. to seek safety and warn pilots of danger.

Radio directional beams that tell the flyer whether he is on his course have provided the latest and, aviators believe, the best weapon so far developed to gain safety. All planes now flying the graveyard route are equipped with radio receiving devices. Headphones on the pilots' ears tell them whether they are on the course. Weather conditions ahead are given by radio. Such a system is costly. But the cost matters little when money is weighed against human lives, costly planes and motors, and valuable cargoes.

TUBE IS BENT BY SPRING COIL WITHOUT FLATTENING

Bending tubing to any degree without flattening is possible with a tool now available. It consists of six steel-spring wire coils to take tubing ranging in size from one-fourth to five-eighths of an inch.

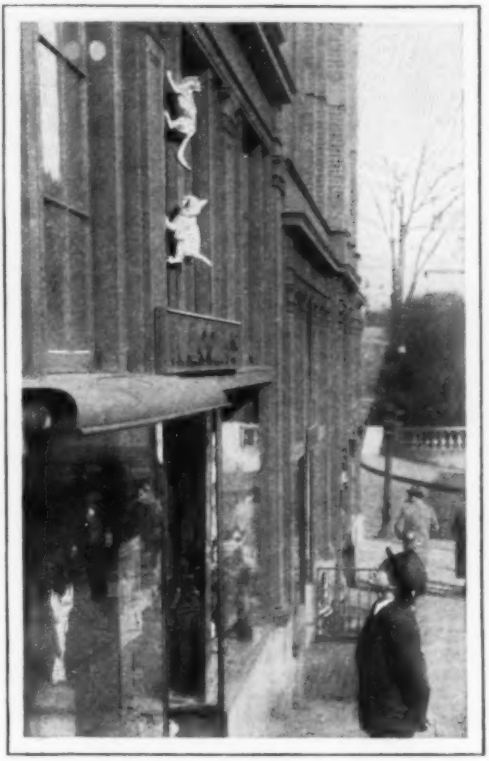
OLD TELEPHONE BOOKS TURNED INTO ROOFING PAPER

Old telephone books serve many purposes after their usefulness as directories is outlived. They are shredded and pulped and come back as roofing paper, imitation linoleum and floor mats. Sawing a large city directory in two, or even cutting it up with an ax, is no mean feat, and it was necessary to design a special machine for shredding. Shredding pawls swing loosely and freely around a bolt in spaces of a rotor which throws the pawls out to strike the books as they are fed into the machine. The successive pawls keep striking, biting and chewing at the books until these are ground to pieces. It was impossible to use rigidly fixed teeth for the purpose because they clog almost instantly. The books offer surprising resistance, even to hardened metals, and the shredder weighs three tons and has a rotor of forged nickel-steel.

EYESHIELD FOR AUTO RACER REPLACES GOGGLES

To prevent dust and other foreign matter from entering the eyes of automobile racers, a transparent shield of durable material is adjusted to the helmet in such a way that it can be lowered in an instant for service or put back out of the way. It is less difficult to adjust than goggles and affords an unrestricted view.

Eyeshield for Motorists Takes Place of Goggles, Is Easily Adjusted and Gives Unrestricted View



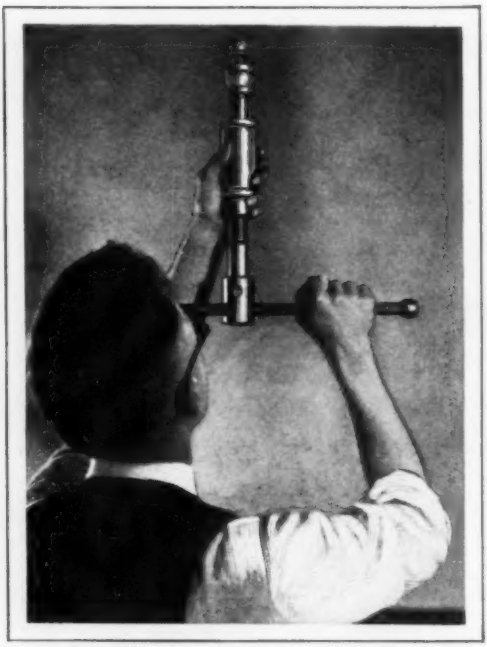
Life-Size Sculptures of Mother Cat and Kitten Attract Attention to Baltimore Novelty Shop

CATS CLAMBERING UP BUILDING ATTRACT PASSERS-BY

Persons passing a Baltimore novelty shop are startled to see what appears to be a kitten chasing a full-grown cat straight up the wall of the building. A closer inspection, however, reveals that that animals are life-size models designed to call attention to other such animals in the shop.

ELECTRIC LIGHTS OVER WATER LURE FOOD FOR FISH

To increase the natural food supply for trout in rearing pools, a sportsmen's association in New Hampshire has taken advantage of the well-known lure of the flame for insects. Bright lights are placed just above the pools and these attract a variety of insects, many of which strike the water and are unable to rise, while the game trout often leap out of the water to snatch others that are hovering in the air near the surface.



Viselike Grip and Powerful Leverage Characterize This Tool for Removing Fittings Hidden behind Plaster

NIPPLE AND COUPLING WRENCH REACHES HIDDEN FITTINGS

Removing hidden fittings from behind the plaster line of walls or ceilings, such as are encountered in concealed sprinkler systems, can be done without cutting away the plaster by using a nipple and coupling wrench designed to reach these almost inaccessible parts. The pipe wrench is equipped with a T-handle which eliminates much of the possibility of accidents due to slipping, that sometimes happen in probing for such fittings with the ordinary wrench. Pressure on the tool causes it to produce a viselike grip and gives a powerful leverage.

DOGS FED ON CHEAPER MEATS HAVE BETTER HEALTH

Choice cuts of meat are not as healthful for dogs as parts generally thrown away, according to Dr. William Lentz, director of the small-animal hospital at the University of Pennsylvania. It would be better for the pets, he declares, to feed them on scraps and internal organs the butcher usually discards, as they would live longer and have less sickness. One reason for this, it is believed, is that the dog naturally would follow the habits of its wild ancestors and prefer other parts of meat rather than the muscular portions usually fed to it, but man has had a tendency to adapt the dog's diet to his own and this has not been beneficial to the animals in all cases. Wild beasts that prey on other animals usually rip the carcass open and devour the internal organs, naturalists have observed, and the dog has the same natural preference. It is believed that the glandular organs contain substances good for the dog, and the softer diet is also more beneficial than harder meats. According to Dr. Herbert Fox, pathologist of the Philadelphia Zoological society, the same rule applies to lions in captivity.

ELECTRIC WALLPAPER PASTER FITS ROLL FOR HANGING

Pasting and trimming a roll of wallpaper ready for hanging in a single operation, an electrically operated paper-pasting machine does away with messy paste tables, pails and other equipment. The roll of paper is run through the machine, passing through a paste reservoir and being trimmed as it emerges, when it is ready for folding and hanging. It eliminates to a great extent moving of furniture and laying of canvas on floors.

Machine for Pasting Wallpaper Is Electrically Driven and Does Away with Messy Paste Tables

¶Our Bureau of Information will answer all questions regarding articles appearing in this magazine.

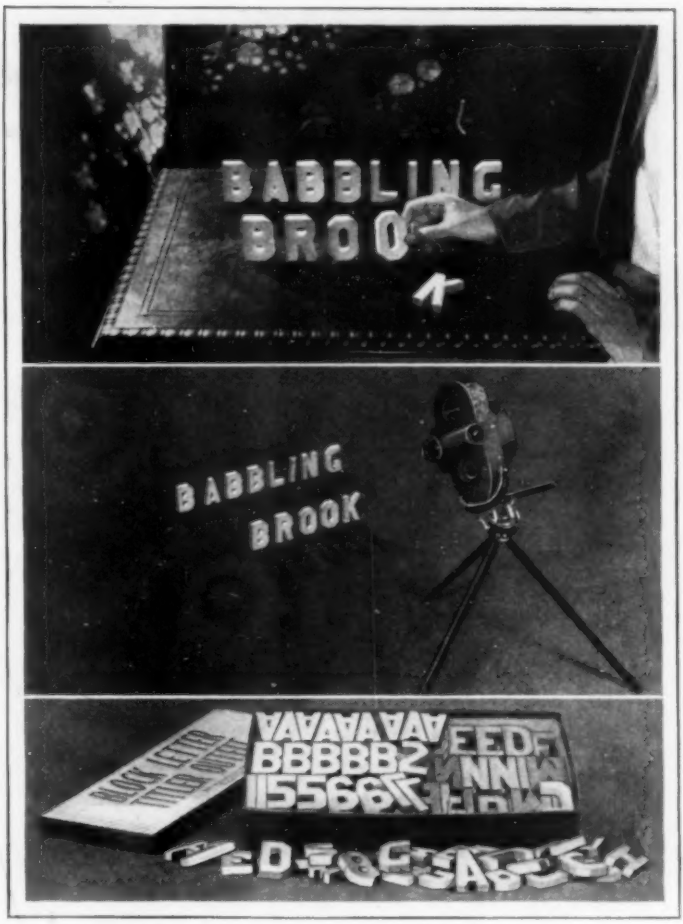
CORNCOB "STONE" HAS MANY USES

A substance, as hard as many varieties of stone and stronger than most kinds of wood, is being manufactured from corncobs through a mechanical and chemical process. The cobs are reduced to a jellylike pulp which is pressed into a mold and hardens into a dense, tough material of a golden-tan or deep-ebony color. It is used for panels, can be cut into gears, washers and other parts usually made of metal, and is a substitute for hard rubber.

SHEET-STEEL ROAD FENCE IS SAFER FOR AUTOISTS

Sheet-steel fencing in place of wire along roads paralleling steep embankments gives greater safety to the motorists, experiments have shown. The sheets have strong spring-steel hinges at the joints which will stand much bending before they break. Also cars striking the sheets at a sharp angle suffer less damage.

Car Purposely Run against Fence, to Show Strength of the Sheet Steel Used Instead of Wire



Setting Up a Title in the Block Letters; Taking a Photograph of It for the Movie, and the Letter Case

BLOCK-LETTER MOVIE TITLES PRODUCE NOVEL EFFECTS

Artistic titles for the home-movie films are now easily prepared with weighted block letters that can be set up quickly with appropriate objects or backgrounds to form attractive titles that could be duplicated with pen or pencil only with the greatest skill. There are 182 wooden letters and seventeen numerals in the set. The characters are of whitewood and are half an inch thick and two and one-half inches high. The weights make it easy to set the pieces upright or they may be laid flat. Unusual effects can be produced by making the letters "perform tricks" with the aid of a dark string and then assume their proper place in the title.

The Wizards of

By GEORGE W. GRAY

ANCIENT alchemists and magicians covered their doings with such mystery that early science came to be known as the "black arts." Nothing could be more typical of the change from darkness to light than the invitation lettered on the office door of Dr. Willis R. Whitney, research director for the General Electric company at Schenectady. "Come in, rain or shine," warmly greeted the sign in bold black letters. So I walked right in.

It was the beginning of a walk into wonders more fascinating than anything ever dreamed of the philosopher's stone. Doctor Whitney, himself a distinguished chemist, is the leader of a group of experimenters who spend their time trying electricity at new tasks—and the work that they have succeeded in getting out of the mysterious genii is truly magical.

Stepping into an adjoining laboratory, I ran into a near-wilderness of glass piping, test tubes, insulated wiring, and other laboratory accessories. The magic of this room was in a curiously shaped vacuum tube. Wires from it connected two plates which stood upright and parallel on a near-by table, separated by a distance of about a foot. One of the laboratory men picked up a large porcelain insulator. "Looks dry, doesn't it?"

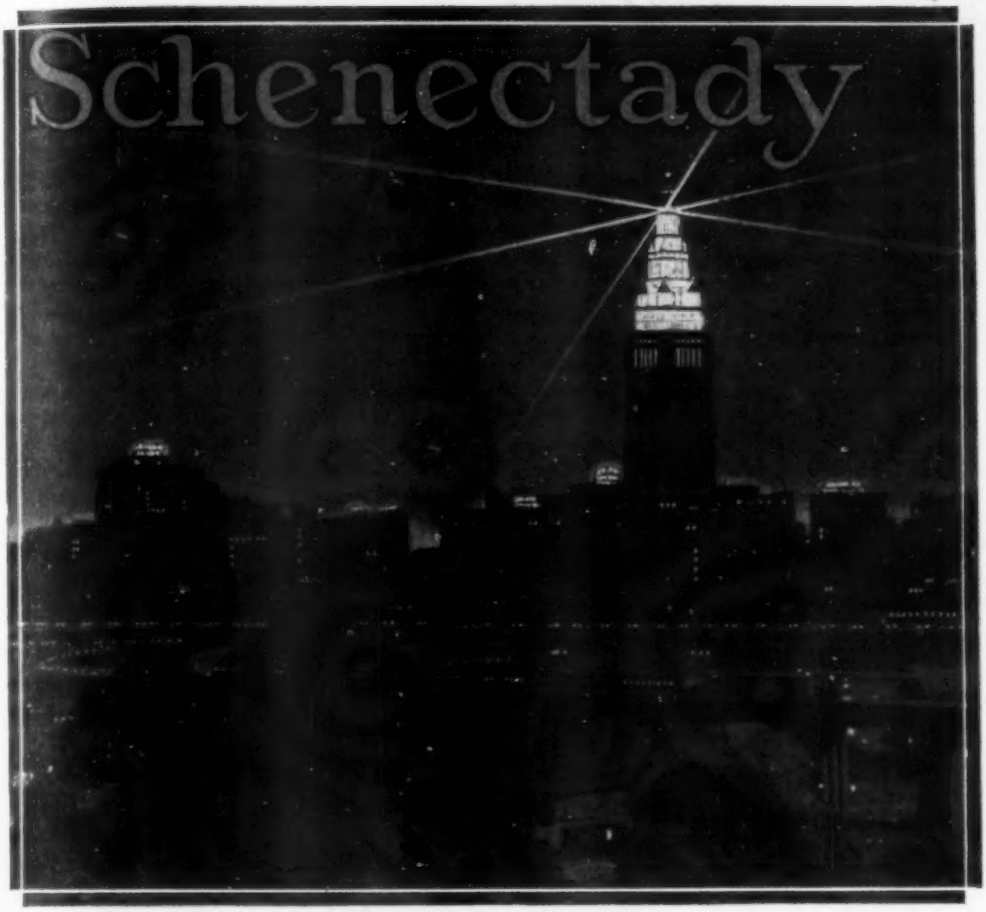
Yes, it seemed as dry as the well-known bone.

He placed it in the space between the plates, turned on a switch and instantly the "dry" porcelain began to steam like a hot wet towel.

"With the old baking methods many hours were required to cook the porcelain dry," he explained, casually. "Now, with this intense radiation—with a frequency of 60,000,000 cycles, five-meter wavelength—the whole job could be done in less than five minutes."

Largest and Smallest Coolidge X-Ray Tubes, and Dr. W. R. Whitney Listening to Electrons

This simple demonstration of the energy packed into radio waves was only a start. In another room, I saw a more powerful tube of the same type. Near it rested an enormous incandescent lamp, rated at 1,000 watts. There were no connecting wires or sockets, but the moment the current was turned into the radio tube, the lamp glowed with intense light—a kind of power transmission by wireless.



Night Views of Modern City Fronts Show the Progress of Electric Lighting; Here Is a Glimpse of Cleveland with Its Splendidly Illuminated Union Terminal Tower

A fly was put in a glass tube and brought near the mysterious bulb of energy. The fly buzzed around importantly, but, almost as soon as the radiation was turned on it, fell to the bottom of the tube dead.

Then a number of flies were put in a glass jar, and through an inlet by means of tubing, a circulation of air, well below the freezing point, was passsed through the container. The effect was that of a blizzard—gradually the flies dropped and lay inert. When it seemed that all the insects were frozen dead in their glass Antarctica, the vacuum tube was set up within a few feet of them, and the electric power turned into it. Presently a fly began to stir, then another, and another. Within a minute there was considerable squirming, and eventually several of the insects were flying around in the freezing temperature, for through it all a thermometer within the jar showed that the air remained at thirty-two degrees Fahrenheit.

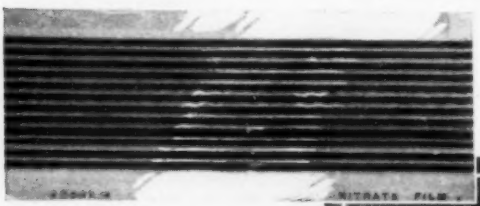
Seemingly, the effect of this radiation on living things is internal. The laboratory men themselves found that, while working with the tube, they began to feel feverish. A physician was called. He noted that, after about an hour's continuous exposure, the temperature of the blood rose, and in some cases the fever reached 100 to 101 degrees.

A recent development in medical practice is the use of artificially stimulated fever to combat certain diseases. This suggested to Doctor Whitney that the

new radio tube might have a use here. Accordingly, he supplied the tube to the Albany medical school in New York and the Mayo clinic in Minnesota, and during the past year specialists in these institutions have been testing its medicinal value. Reports of their results are awaited with keen interest.

Another possible application is the wireless transmission of power, but in this possibility Doctor Whitney has little confidence. "The energy rapidly falls away with distance," he explained, "and about ninety-nine per cent of the power is used in transmitting the remaining one per cent. This is too great a cost; wires are cheaper. There is, however, a real field for the use of wireless transmission in the remote control of electrical apparatus, and here may develop an important field for the industrial application of this radiation."

Leagued with Doctor Whitney in this



many-sided exploration of electricity are Dr. W. D. Coolidge, the physicist, and Dr. Irving Langmuir, the chemist—though one can only wonder where the one's physics leaves off and the other's chemistry begins, so intertwined now are these basic sciences.

In Doctor Coolidge's laboratory the electronic wizards were working with a vacuum tube of a different type, an X-ray tube designed to operate at the enormous pressure of 400,000 volts. Why so powerful?

"Because we want deeper penetration," answered the young scientist who was on the job here. "Our most powerful X-ray tube in use today operates at 250,000 volts and is able to penetrate three and one-half inches of steel. But we make turbine castings many inches thick, and we want an X-ray which will photograph the inner structure of the steel and show up any deep-lying flaws. Our immediate goal is a 400,000-volt unit, and when that is attained we hope eventually to get a controllable X-ray tube at 900,000 volts."

Even now, the radiation from the 250,000-volt tube is so penetrating that men in adjoining rooms would be involuntarily X-rayed through the walls if the tube were operated unshielded. Some of them hung up a jawbone on the wall in front of a holder containing a photographic glass plate. When they developed the plate, hours later, they had a photograph of the bone, though the X-rays in reaching it had traveled more than thirty feet and passed through two walls.

The projected 400,000-volt tube was in process of being exhausted of its air. Three pumps were working in series—a force pump in the basement, an oil pump in the room, and directly beside the tube

Sound Track on Motion-Picture Film, and Handling Atomic-Hydrogen Flame at 6,400 Degrees Fahrenheit

Battery of 100-Kilowatt Radio Tubes; Six of These, in a Recent Test, Transmitted a 200-Kilowatt Long-Wave Broadcast, Which Was Heard West of Hawaii

a mercury-vapor pump of the powerful type invented by Doctor Langmuir. Before his invention, hours were required to pump a tube down to the lowest vacuum attainable. And even then, the vacuum was rather thickly populated with air molecules. Now, with the Langmuir mercury pump, it is easy to attain within a few minutes many times nearer an absolute vacuum than was possible at all under the old conditions.

Doctor Langmuir's inventive genius has shown itself in many directions, but nowhere more strikingly than in his atomic-hydrogen flame.

"Just look through that window there," instructed the laboratory man, "and you'll see what it can do."

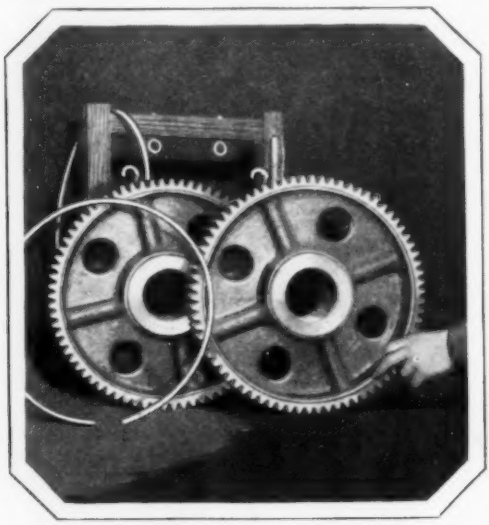
"Which window?" I wondered, glancing at the smooth wall of the adjoining partition he had indicated, and which I now saw was heavy glass, black as the pit. "Can anything be seen through such blackness?"

"You'll see all you want to see," he retorted with a chuckle, as he put on a heavy asbestos helmet and disappeared behind the partition. And in a moment I saw—about all my eyes could stand.

A flame leaped out in the darkness and illuminated the hidden interior. It spurted from a contrivance which the helmeted man held in his right hand, and as he directed the flame against the side of a fire-clay crucible, the clay melted and bubbled away like butter. The hardest metals ran like water under the fury of this heat.

Its temperature, 6,400 degrees Fahrenheit, is the hottest that man has yet been able to produce. And it is attained, not by anything burning, but by allowing the atoms of hydrogen, which have been burst from their accustomed systems by an electric arc to recombine into molecules. The atomic-hydrogen flame is being introduced in industry for welding metals and alloys, such as chromium, nickel, copper, aluminum and silver, as well as for ordinary iron and steel.

The anti-noise campaign now active in several cities may find an ally in a new type of gear recently developed in the



Non-Resonant Gears, with Steel Ring That Slips inside Rim, to Eliminate Half of the Noise

laboratories. I encountered it first in a room where two large gears hung side by side. "Give them a knock," suggested the laboratory man, offering a hammer. I hit the wheel on the right; it rang like a church bell. Then I struck the other wheel—there was only a dull thud, and the sound faded almost as soon as it began.

"Both are the same size and of the same material," explained the expert. "The only difference is that the non-resonant wheel has a ring of steel fitted into it, just inside its rim. This absorbs and damps all resonance within the wheel—and tests show that fifty per cent of the noise of gears in trolley cars and other machines is resonance noise. Now, if somebody will kindly eliminate the other fifty per cent caused by the cogs—then we'll have really silent gears."

Quite at the other extreme is the electric book, which is all sound and nothing to look at. I sat in a quiet room and a voice out of a hidden loud speaker began to read. The speaker was actuated by a film in which wavy zigzag lines of light control the sounds. The ordinary moving-picture film stock is used for the record, and it has been found possible to photograph fourteen parallel sound tracks on the film—sufficient to provide over two hours of reading with a 400-foot film.

Radio communication, which owes so much to Langmuir's explorations within the vacuum tube, continues to be a main line of research here. At the experimental broadcasting station WGY, five miles south of Schenectady, I saw the engineers setting up the 200-kilowatt transmitter which was put to the test last March. Remembering that the most powerful broadcasting station now operating commercially uses but 50 kilowatts, you can realize what a tremendous jump in power has been attained by the Schenectady wizards.

These five-foot super-power tubes, when set in their water jackets, are seven and one-half feet long. So rapid is the heating of the plate while operating that fifteen gallons of water per minute are needed to cool each tube. Once a tube was left outside its water jacket. Within three minutes there was a "plunk" as the tube collapsed inward. Each of these giant tubes costs $1,600 and has a life of about 1,000 hours.

Short-wave transmission also is the object of almost continuous experimenting at WGY. Half a dozen steel towers of varying heights are spotted over the fifty-acre lot, and many types of antenna are in use. The beam antenna developed to communicate with the Byrd expedition in the Antarctic is there. It is said that the wire screen used as a reflector with this antenna increased the efficiency of transmission to twenty times that of the unreflected wave. Another beam at WGY points to Australia.

Separate from this sending station is the receiving laboratory which stands on a high hill amid the farms north of the city. On a clear icy morning, I arose at daybreak and made the eight-mile trip to this hilltop for the precious privilege of talking with Australia. Mr. A. B. Hitt, the Schenectady operator, introduced me over the wireless to Mr. P. M. Farmer, operator in Sydney. Then, over 10,000 miles of land and ocean, we exchanged reports on the weather, discussed the fact that the clock was approaching midnight in Sydney while the working day was just beginning in Schenectady—talked airy nothings, of course—but it was a tingling experience nevertheless

Coming out of the station into the

bright sunlight, I could barely see the misty peaks of the Adirondacks only a few miles to the north, but I had just heard a man's voice halfway around the globe, and had got his every word and accent clearly and instantly. Magic! Is there anything in the Arabian Nights or any dream of the old alchemists to equal this actual experience in wonder and improbability? Such miracles the wizards of the laboratory are steadily and surely making commonplaces of everyday life.

CHERRY BLOSSOMS REQUIRE SUN TO PRODUCE FRUIT

No matter how profuse the blossoms on a cherry tree, the fruit will be missing if cloudy weather prevails, or the branches are so close together as to shade the blossoms. Artificial shading of productive trees during the blossoming period results in pollination, but less than one per cent of the blossoms set fruit as compared with more than eighteen per cent for adjacent unshaded trees.

TRUCK WITH FLEXIBLE FLOOR UNLOADS AUTOMATICALLY

London coal trucks are being equipped with flexible flooring, operated electrically on the principle of the endless conveyor. Loading and unloading coal and other bulky material is accomplished quickly, the flooring coiling under the truck as its load falls to the ground. In loading, the operation is reversed.

Truck with Flexible Flooring on Endless Conveyor, Which Loads and Unloads Automatically

Special Compartment for Warming Plates or Food, Which Attaches to Ordinary Steam Radiator

HEAT CHAMBER IN RADIATOR KEEPS DISHES WARM

To warm plates or food, a steam radiator has a special compartment with doors. The recess holds a number of articles, is set at a convenient height and the arrangement does not decrease the efficiency of the radiator.

DAM STOPS LOSS OF LAND

Soil-saving dams have been used successfully in Wisconsin to fight the erosion of valuable farm lands through gullies and streams into neighboring states. Flood waters and spring rains were found to be a serious menace to fertile land, particularly in hilly regions, one gully having eaten ninety acres out of the heart of a 250-acre farm in a few years. The gullies are now dammed, the water from the pond above the dam being carried to the desired level below by lines of sewer tile, laid horizontally with the intake curved upward and at some distance from the floor of the gully, to provide a settling basin for the silt. Thus the gully gradually is filled with earth that settles to the bottom of the pond area. Every gully can be forced to make its own delta and thus be kept under control.

¶Several successful flights with airplanes powered by outboard motors have been made recently.

Umbrella-Like Tent That Serves as Place of Concealment for Photographer and His Camera in Taking Pictures of Birds at a Pool

HIDE-AND-SEEK TENT IS USED TO PHOTOGRAPH BIRDS

To obtain close-up photographs of birds that drink from a garden pool, Dr. Paul Bartsch, curator of the National Museum, uses an umbrella tent for shelter and concealment for himself and camera. He focuses his lenses and awaits the arrival of the birds. As many as seventeen varieties have been photographed in fifteen minutes at the pool.

ALUMINUM-COATED WALLPAPER

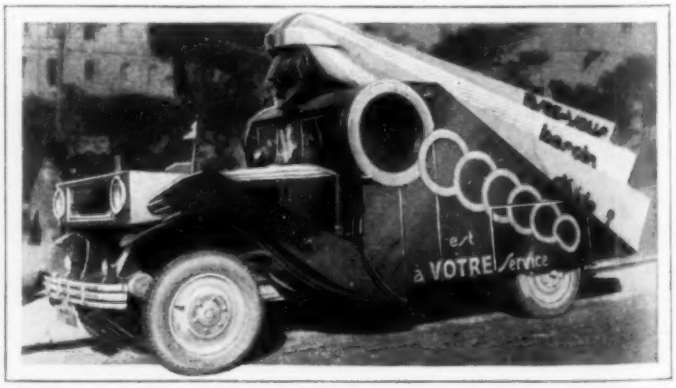
Metallized wallpaper, a thin sheet of aluminum backed with paper, has come into use recently. It has a bright finish that does not tarnish, and when soiled may be restored by cleaning with a damp cloth. Embossed patterns give a variety of designs. It does not glare or reflect light, but diffuses the rays and is particularly appropriate for sun rooms, bathrooms and hallways. Unusual effects are obtained by stippling or coloring the metal paper after it has been applied.

AIRPLANE EXPANDS TO FIT LOAD

Detachable sections, to increase or decrease passenger accommodations according to requirements, are provided in an airliner being constructed in Holland. The expanding plane is so arranged that an extra ship can be added or removed, depending on the number of passengers to be carried. The ship is built as a fast monoplane to carry six people, but by adding a lower plane of equal size, the machine becomes a biplane with room for ten persons. The change can be made quickly and the cabin is large and wide. Any engine can be used, up to sixteen cylinders, developing 1,000 horsepower.

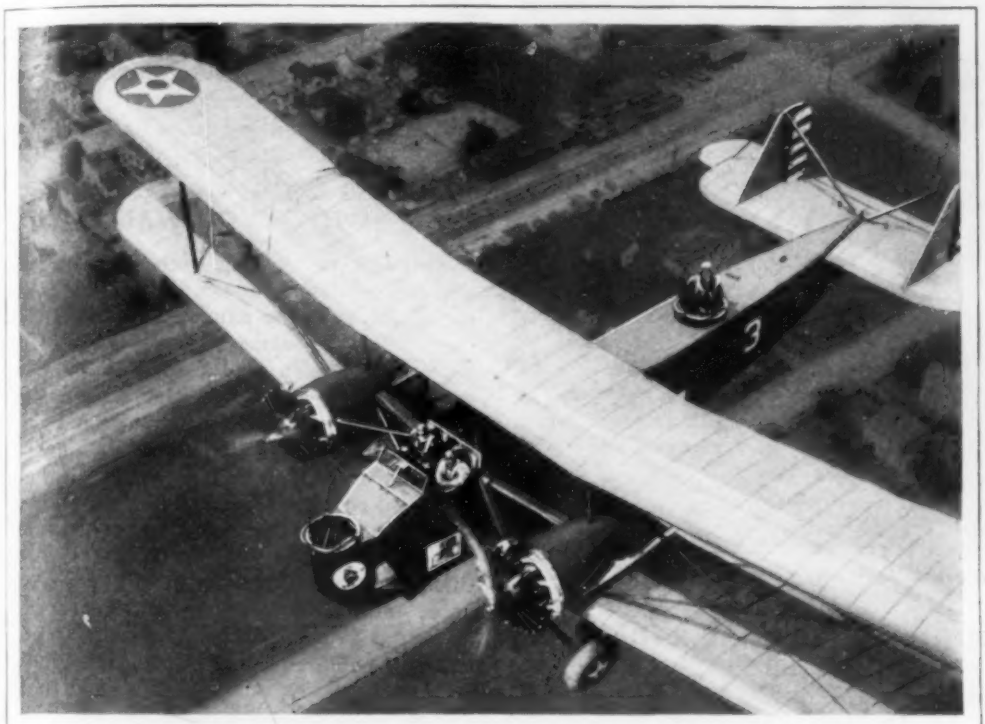
FIRST-AID CAR FOR MOTORISTS HELPS STRANDED DRIVERS

First aid for stranded motorists is offered by a hospital on wheels that travels the French highways and helps the unfortunate driver. The car is equipped with tools to repair disabled autos and is unusual in appearance, the top being decorated with the head and flowing veil of a nurse. The ambulance for autos is maintained by a manufacturer to advertise his product.



First-Aid Car for the Motorist Whose Auto Has Broken Down by the Roadside; It Travels the French Highways to Give Help to Drivers

LOOKING DOWN ON UNCLE SAM'S LATEST BOMBER



This Photograph, Taken from Another Plane, Shows One of Uncle Sam's Largest Bombers on the Wing; Note the Pilots at the Controls and the Gunner Looking for the "Enemy"

From another airplane, a photographer obtained an unusual close-up picture of a huge army bomber on the wing during recent air maneuvers launched from Bolling field. The camera was snapped as the big bomber soared over Baltimore and showed the pilots at the controls with the gunner in the rear gazing about him for the hypothetical "enemy."

AIR RETARDS SPEED OF AUTOS

Air plays a large factor in the speed of automobiles, particularly at high rates of travel. When cars travel above forty miles per hour, more power is required to overcome air resistance than road resistance. At fifty miles, the wind resistance of the ordinary motor car is between 110 and 170 pounds, absorbing from fifteen to twenty-three per cent of the engine's power. At 100 miles an hour the figures would be quadrupled. Besides increasing speed, streamlined automobiles have the additional advantage of not stirring up dust clouds on dirt roads.

PHONE BOOK INDEX LETTERS SAVE TIME FOR USER

Transparent letters with gummed backs now may be obtained for indexing the telephone directory to save the time of the user in searching for numbers. The index letters are quickly applied in the proper positions on the edges of the pages, and last the lifetime of the directory.

¶Whenever you find that you wish to know more about any article in this magazine, write our Bureau of Information.

Humless Alternating-Current Tube That Eliminates Much of the Noise of Electric Radio

HUMLESS ELECTRIC RADIO TUBE IMPROVES RECEPTION

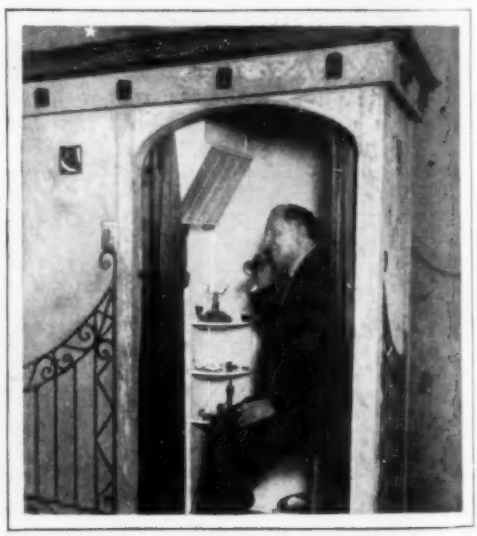
Taking the hum out of the electric radio is the purpose of an alternating-current tube recently announced. The tube was produced by the alteration of various vacuum-tube elements, and is said to remove virtually all the audible hum that has been one of the annoying problems faced by the industry ever since the electric radio was introduced

HOUSES RIDDED OF WHITE ANTS BY CATCHING THEIR QUEEN

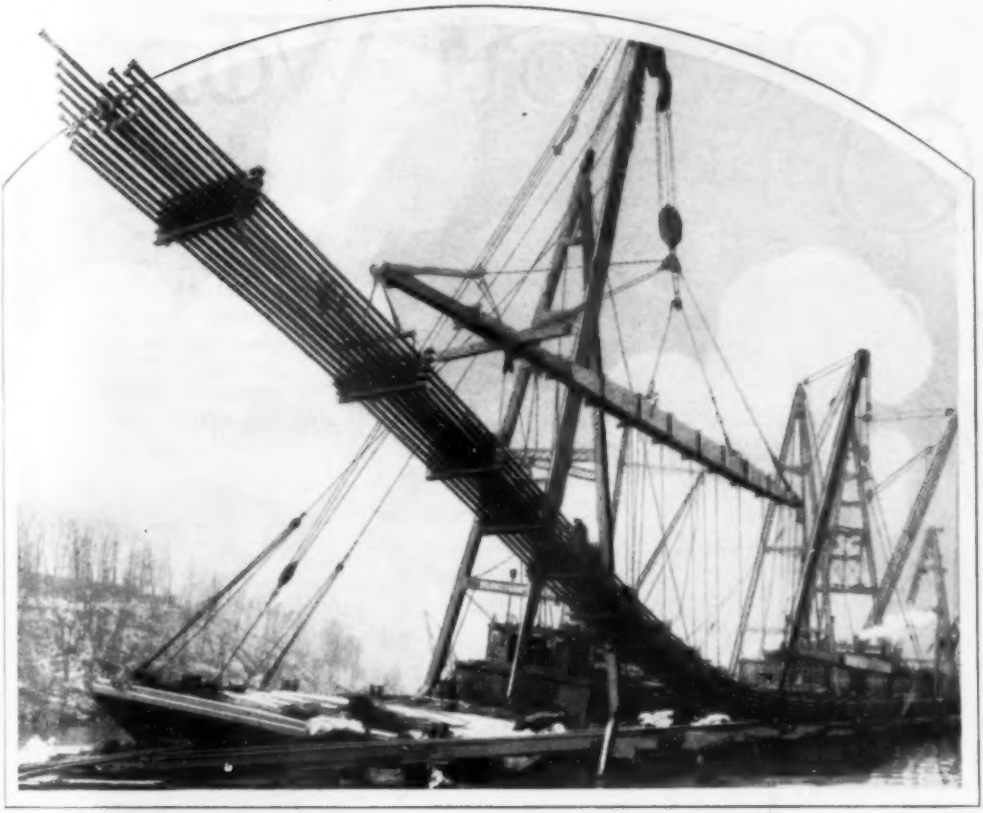
White ants, or termites, which do much damage to houses in India, reducing the hardest woods to powder and destroying rugs and carpets, are attacked through their queen by the native Hindu ant catcher, or diviner. These tunneling ants work in darkness, boring under walls and ceilings and beneath and behind floors and wainscots, eating away the underside of an article that appears sound on the surface. The ant catcher taps floors, walls and ceilings until he finds a spot that sounds dull or hollow. Digging under the floors from this point he searches until he finds, about six feet below, a mud shell containing a fat white chrysalis from which tunnels radiate in all directions. The grub is the queen ant, and when it is removed, the workers forsake that particular part of the underground system. Sometimes a dozen or more must be removed to clear a dwelling of the pests.

MOVIES MADE OF YOURSELF WHILE YOU WAIT

Vest-pocket moving pictures of yourself can now be made with a self-operating and developing camera somewhat like the automatic cameras with which the subject is able to take a strip of still pictures of himself. The electric-powered movie camera, capable of turning out 360 pictures an hour, is operated by merely pressing a button. The subject enters a booth equipped with a telephone and other pieces of "property," which he may use in various poses and actions before the camera. The finished product appears in a small screen frame which becomes animated through pressure of the fingertips on the edges of the frame, four inches long and nearly two and one-half wide. The entire operation, from "shooting" in the little booth studio to "screening" in the vest-pocket frame, requires only six minutes. It is planned to operate the self-serving movie in the same manner as automatic still-picture studios.



The Man in the Booth Is Making Movies of Himself with an Automatic Moving-Picture Camera



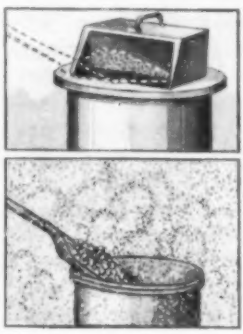
Courtesy New York Central Railroad

Laying Wrought-Iron Pipe Conduits for Electric Wiring under the Harlem Ship Canal; Thirty-Six Lines of Pipe Were Tied Together as Shown, Bent to Conform to the Channel Bottom and Lowered

LAYING WIRING UNDER CANAL TESTS ENGINEERS' SKILL

Engineers were faced with a problem recently in laying high-tension wires under Spuyten Duyvil or the Harlem ship canal, a six-hundred-foot stretch of water separating Manhattan from the mainland. Submarine cables were out of the question as they would be likely to foul the ships; various kinds of piping had to be discarded because of the danger of broken joints, leakage, and the likelihood of rusting and corroding in the salt water. The material that finally proved successful was wrought-iron piping. More than 23,000 feet of it was assembled into lengths of 650 feet, yoked together in thirty-six ducts of nine lengths each, and the entire assembly bent to conform to the bottom of the stream. With the aid of a diver, the pipes were lowered in less than a day, a Sunday when traffic on the canal was suspended. The pipes were filled with oil to ease the operation of drawing the power lines through.

SWINGING DOOR FOR ASH CAN KEEPS DUST INSIDE



To prevent dust from escaping from the ash can, the receptacle can be equipped with a trapdoor which operates automatically. The door, set upright in a frame in the cover, swings inward when a shovel is pushed against it, but returns to the closed position as soon as the shovel is withdrawn, thus keeping the dust and dirt inside.

So You Won't

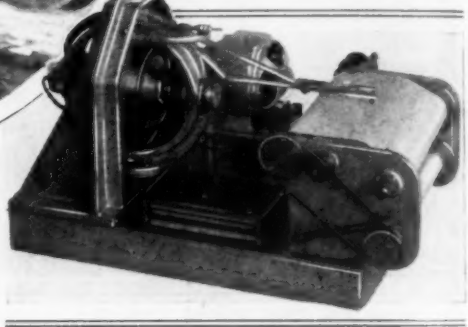
By JOHN V. DRAPER

IF EVER you have gone on a vacation tour on cushions of air, you have probably shaken hands with "auto-intoxication," induced by long hours behind the steering wheel.

This condition was once known as muscular fatigue, but recent discoveries now identify it as nerve fatigue. It manifests itself in many different ways, such as dizziness, headache, roaring in the ears, muscular stiffness and soreness, nausea, tired eyes, nervousness and sensations of falling forward.

Motor-car manufacturers have expended fortunes to improve springs, shock absorbers, cushions and other things that facilitate increased riding comfort. The majority of these accessories have fallen short chiefly because no dependable "yardstick" was available for measuring riding comfort. Engineers were forced to rely on human recorders—the drivers and passengers—for actual data about the "rideability" of different makes of cars equipped with various comfort devices.

That is why the Society of Automotive Engineers, aided financially by a dozen different automobile manufacturers, assigned to Dr. F. A. Moss, of George Washington University, the task of finding an efficient method for measuring comfort in automobile travel. He attacked the problem by originating several devices, which he calls "wabblemeters," for measuring the loss of equilibrium, or balance, which the average motorist suffers after an all-day excursion.



Car Equipped with Gauge to Show Its Riding Qualities, and Close View of Recording Apparatus

The first apparatus featured a metal bar placed under the balls of the subject's feet as he attempted to balance on his heels for a given interval. If the subject lost his balance, the resultant movements of the bar would complete an electrical circuit and would be signaled by either an electric bell or a counter.

The second wabblemeter was of improved design and consisted of a platform balanced on a universal joint. The metal rods projecting from the front corners of the platform make contacts with a metal bar, if the platform is moved too far up or down. This completes an electrical circuit, and each contact is indicated by a bell or counter.

Another wabblemeter is similar to the one just described except that it is also equipped with special pumps which operate like pistons and move a certain fluid whenever the platform is forced out of

Feel the Bumps

Subject Riding a Stationary Bicycle Fitted with Instruments That Measure the Muscular Fatigue Experienced in the Process; Scientists Are Determining How Tired a Person Becomes in Driving, and Why

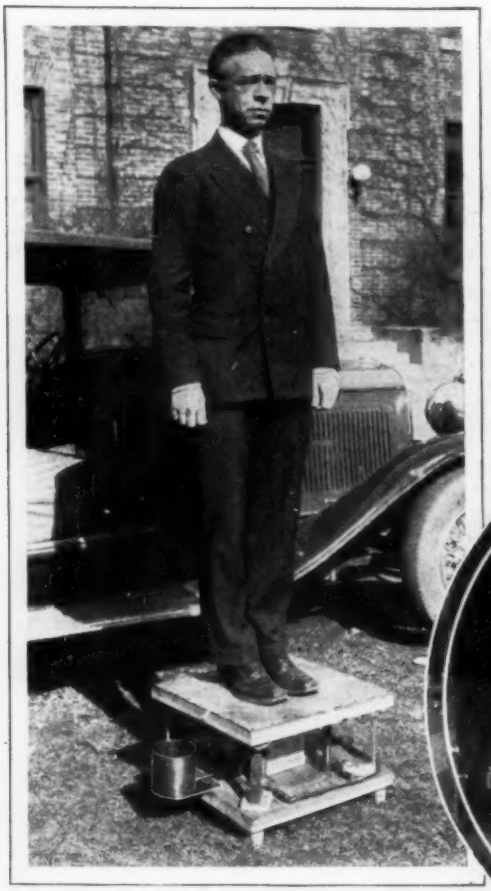
balance. The fluid is collected in a graduated tube where it is measured.

The successful operation of this device led Doctor Moss to invent yet another wabblemeter which produces a graphic record of the loss of balance or bodily sway that results after long automobile rides. It consists of a platform mounted on a ball-and-socket joint and is equipped with recording pens that register the results of the test on a revolving drum. These mechanical penmen draw a straight line when the motorist under test shows no indications whatever of loss of equilibrium. Wabbles are recorded as up and down variations from this straight line.

The results of the experiments indicated that riding fatigue does not represent a very marked muscular fatigue, but more closely approximates what Doctor Moss terms nerve fatigue. Scientists formerly have claimed that any such condition as nerve fatigue did not exist. Recent research, however, has brought to light the interesting fact that nerves are reduced measurably in tissue substance in conducting impulses and that, under conditions of exercise, they display chemical and energy changes very similar to those shown in a fatigued muscle.

Students who volunteered for the tests were first of all subjected to mental multiplication for five-hour periods to determine the normal nerve fatigue induced by such effort. Thereafter, they were tested in number checking, speed of reaction in tapping a telegraph key, hand steadiness and basal metabolism—individual consumption of oxygen.

These same subjects then were taken on long automobile rides, ranging from 150 to 300 miles, over a variety of roads. At the end of each trip, the "tourists" were again examined as above. An eight-hour ride over a very rough road showed a decrease of as much as 16.9 per cent in efficiency in number checking as compared with an average decrease of 2.6 per



being made more comfortable by the use of specially designed cushions.

Professor Fox, aided by several leading automobile manufacturers who conducted supplementary tests at their proving grounds, developed a standard bump test by means of which the riding quality of any model or make of motor car may be readily determined. The standard bump is an obstacle, five and five-eighths inches wide and two and five-eighths inches high, fastened to the experimental highway. The test car is driven over it at different speeds, while the gyro-accelerator, that is

The "Wabblemeter," Which Measures Loss of Balance, and a Gyro-Accelerator Installed in a Car

cent as a result of fatigue produced by mental work in the laboratory.

The gyro-accelerator, originated by Prof. M. L. Fox, of the University of Iowa, is the most efficient instrument yet devised for studying the actual automobile motions which cause fatigue. It gives an accurate measure of those forces which disturb the occupants of the automobile during a long drive.

Riding discomforts which induce muscular and nervous fatigue among motorists and passengers are due to vibrations at certain speeds, the sidesway of the motor cars, the force with which the riders are thrown when the cars pass over bumps or chuck holes, the fit of the seat cushions and the noises of both automobile bodies and engines. The causes of noise and vibration are being ferreted out and remedied by motor-car manufacturers as rapidly as may be, and many automobiles are

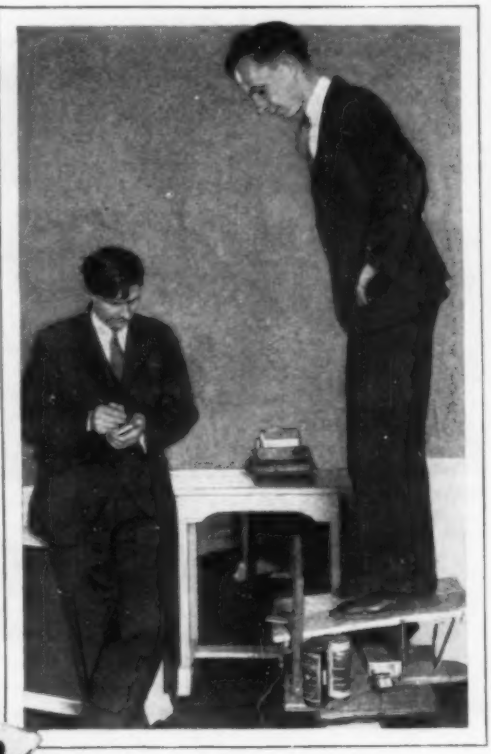
mounted in the tonneau, records what happens. When the car hits this simulated bump, a portion of the thrust is absorbed by the tires. Then a motion is developed by the bump that causes the body to nose down before it reacts to the effect of the upward thrust caused by the front wheels passing over the obstruction. This upward thrust forward produces a movement of the car body in counter-clockwise direction as viewed from the right side. The front of the car rises gradually to a peak position and then starts downward again. When the rear wheels pass over the bump, a rapid change takes place.

The time at which this reaction from

the rear combines with the motion of the car depends on the speed of the machine and on its wheelbase. If it combines just before the front end attains the peak position of its upward movement, the motion resembles a strong "kick," and is very objectionable to the occupants. At other speeds, this rear-end motion combines with the front-end movement in such a way as to be more or less neutralized by the body motion.

At Iowa State College, riding-quality tests have been made by U. L. Gunder and T. M. Mason, engineers in the department of industrial arts, who have a number of suggestions for the man who is thinking of making his automobile last another year or so. A little attention to a few simple details, they point out, will eliminate some of the more bothersome jolts and jars.

Testing Lack of Equilibrium after Long Ride, and a Breath Test on Motor-Car Passenger after a Long Journey



Like a human being, an old car needs more attention than a new one. For instance, it should be greased more frequently. Grease the springs to keep out rust, but don't use lubricating oil on them, especially if the car is not equipped with snubbers, for the oil will make them too flexible and the car will suffer needless bumps. Snubbers are recommended for all cars.

A common source of discomfort may be in the wheels. Balloon or semi-balloon tires have proved to be more comfortable than the high-pressure type, but it is important to keep them inflated to the degree recommended by the manufacturers. In a closed car, unpleasant noises and vibrations arise when the rubber bumpers against which the doors close become worn or loose. Install new bumpers or use paper wads, or other material, for a temporary solution of the trouble. Sometimes an improperly adjusted door can be put in order by giving the lower hinge a twist with a wrench. This throws the bottom of the door over and up, causing it to close more tightly.

Many drivers pay too little attention to the cushions. Few seat cushions wear out entirely, but most of them need renewal or repair after long service, one of the chief reasons being that the springs push up against the padding and thereby develop uncomfortable hummocks. This difficulty is easily remedied by replacing the old pad. Another important point is the shape of the cushion and the angle of the bottom pad. To relieve the driver of much of the strain, to help support his

Test Car Equipped with Gyro-Accelerator to Measure Riding Qualities, and a Bicycle-Wheel Velocity Recorder Attached to Running Board

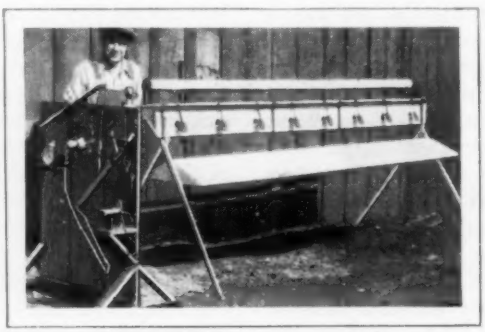
legs and give greater ease in driving, a seat pad that inclines toward the rear, tending to hold the occupant of the seat against the back, has been found better than a level pad. A block of wood slipped under the front edge of the seat cushion often removes a common source of discomfort. Many persons enjoy a pad that has much resilience, but on long rides especially, a comparatively solid one will usually produce less fatigue. The reason is that, if the cushion is too soft or springy, the body will keep bouncing up and down with tiring results. The problem of car comfort rests chiefly on the matter of springs, the design of the automobile, and other factors that the owner usually cannot alter without great expense. The shock absorber was developed to answer the need for greater comfort, but before the car owner purchases and installs a set, he should make sure that the particular type he chooses is suited to his car.

RADIO MOVIES ON STEEL TAPE

Recording radio movies on a thin steel band instead of a film recently was demonstrated successfully in Berlin by a Hungarian inventor. The object to be reproduced is scanned by a ray of light as in ordinary picture transmission, but instead of being photographed, is recorded on a moving steel band in the form of magnetized areas of varying density. This is accomplished by converting the light into electric energy by means of the photoelectric cell, and passing this energy into two electromagnets between which the steel tape passes from one roll to another. Thus the strength of the electromagnets varies with the intensity of the reflected scanning ray. At the receiving station the procedure is reversed.

AUTOMATIC POULTRY FEEDER OPERATED BY CLOCK

To enable poultrymen to feed their flocks regularly without going near the chickens, an automatic feeder has been made to run by electricity. A time-clock attachment allows the operator to set the feed hoppers for any desired hour. Grain, when released, is scattered by a spreader. For night feeding, a lighting attachment is provided.



Automatic Poultry Feeder Operated by Time Clock, Which Feeds Chickens at Any Hour Desired

PAINT ICE BLACK TO OPEN LAKE

Because black absorbs the sun's rays and holds heat, an ice-bound steamer in Lake La Barge, near the headwaters of the Yukon river, was liberated from the winter ice one month earlier than usual. With brooms and buckets, a strip of lamp-black and thinned refuse oil, twenty-nine miles long and forty feet wide, was swabbed across the ice in the lake to the river. In a month the strip cut a channel a foot deep as evenly as though sawed, and it continued to grow until the Yukon liberated the lake water with the spring flood, enabling the boat to get under way.

BIG MACHINE GUN MOST DEADLY WEAPON EVER MADE

Described as the most deadly weapon ever made, a machine gun capable of firing fifty-caliber bullets at the rate of 800 a minute for a distance of nine miles, recently was demonstrated before a group of government officials at Washington. The super-gun, much larger than the ordinary kind, will be used by the navy which has contracted for manufacture of the weapons in this country.

Machine Gun That Shoots Fifty-Caliber Bullets at the Rate of 800 a Minute for Nine Miles

Music Scale for Children Consisting of Drawings of Animals, First Letters of Which Represent Musical Notes

ANIMALS DEPICT MUSIC NOTES TO TEACH CHILDREN

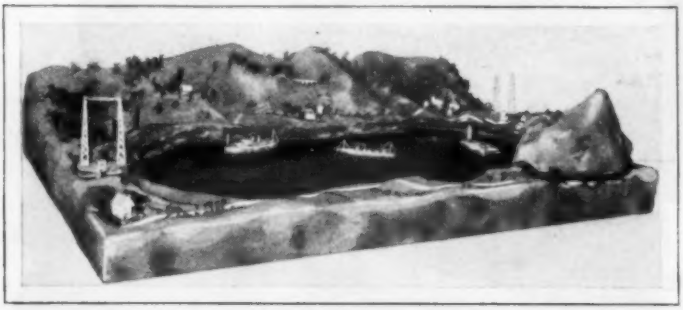
Instead of ordinary music notes representing the scale, a London instructor uses drawings of animals and other familiar objects to teach children the first principles of music. The first letter of the animal or object represented by the drawing is the same as that of the music note in the scale, "D," for instance, being depicted by a donkey, and "E" by an egg. The method has been found to simplify the first steps in music for the youngsters by attracting and holding their interest.

HUGE OFFICE STRUCTURES RUN LIKE A SMALL CITY

Managing a big office building or skyscraper is almost the equivalent of running a small modern city. One thirty-four-story building in New York has what corresponds to a city police department, fire department, health department, street-cleaning force, department of gas, water and electricity and one for transportation. In the building itself are a bank, school, hospital, library, recreation center, newspaper, brokerage office, several restaurants, and shops catering to almost every need. The elevators carry more passengers than the street cars of many modern cities, transporting 50,000 persons a day. A private telephone exchange and a mail and letter division aid in intercommunication between tenants of the building.

NAVY BATTLE IN SHOW WINDOW IS RUN BY CLOCK

Three miniature war vessels go through all the maneuvers of a hot naval engagement in a tiny bay as part of a window display which has attracted much attention because of the mystery surrounding the precise movement of the boats in the water. The bay is fitted like a first-class naval base with wireless towers that work, a fort, guns, a lighthouse and a warship, a destroyer and a submarine, each boat carrying a wireless tower. They are not attached to wires or strings, each moving independently and they cross and recross each other's path. A moving story is told in the maneuvers, an enemy submarine entering the bay past the lighthouse, whereupon coast-defense guns open fire, the flash of the guns and the splash of the shot being seen. The submarine submerges as the cruiser starts out and travels under water until it is able to fire a torpedo at the cruiser, which is hit. The undersea craft comes to the surface and leaves the harbor with the destroyer in pursuit. The latter craft then tows the cruiser back to port, the boats all taking their original positions, when the action is repeated. The entire maneuver takes three and one-half minutes. The display is controlled electrically. Dry-cell batteries are used for operation and radio tubes enter into the construction, there being 3,000 feet of wire and 300 connections. Nine volts are developed and the movements of the boats and the firing are controlled by an arm going around on a commutator. The entire action is regulated by a time-clock arrangement, but if the clock is cut off while the boats are in action, they will complete the battle and return to port before stopping. Every part of the display, including guns, is built to a scale of one five-hundredth of an inch.



Miniature Naval Base in Which Tiny Vessels of War, Governed by a Time-Clock Arrangement, Go through Many Intricate Maneuvers

QUEER TRACTOR DOES WORK OF SIX HORSES

Designed especially for row-crop farming, a four-wheel-drive tractor has proved itself capable of performing any task on a farm that a four or six-horse team can do. It has three-point suspension with balanced traction, enabling it to pull its load in loose or wet soil such as encountered in the corn and cotton belts. Skidding front wheels are eliminated in making turns up or down hill in loose dirt, and for cultivating, it straddles two rows and can be attached to any two-row cultivator or other farm implement. It has a thirty-inch clearance between axles and ground, and the operator can ride the cultivator and still have complete control of the tractor. For haying, it straddles the windrow, and will also handle a double-row lister or two bottom-plow, as well as horse-drawn binders. Steering is done with the conventional gear connected to the front wheels.

Showing Flexibility of a Four-Wheel-Drive Tractor Which Does the Work of Six Horses on the Farm

CAPTIVE PLANE GIVES ALL THE THRILLS OF FLYING

Full-Size Captive Airplane Held in Wind Tunnel Where Novice May Work Controls and Experience Thrills of Flying

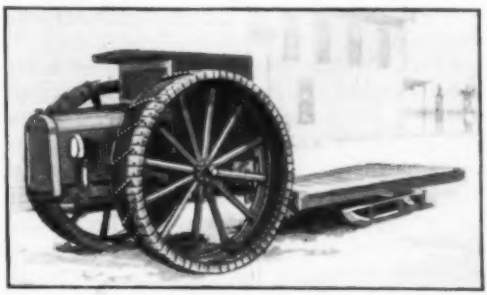
Giving some of the sensations of flying without attendant risk, an amusement device consisting of a full-rigged captive airplane in a wind tunnel, is attracting thrill seekers. The wind tunnel is thirty feet long and inside is a ship, seventeen feet long, with short wings. A sixty-horsepower motor swings an eight-foot propeller to maintain a 100-mile an hour wind, causing the plane to rise about six feet off the ground. In this position all the movements of a real ship in flight may be simulated by operating the controls. In addition to its value as an amusement, the apparatus is expected to be of use in instructing student flyers.

HALT CARELESS AUTO DRIVERS WITH LINES OF LIGHTS

Automobile drivers who frequently ignore the ordinary stop lights at street intersections, can be made to heed the signals by a different arrangement of the lamps, tests in England have disclosed. Instead of having the signals suspended from poles, a line of red lamps is imbedded in the pavement entirely across the street. When traffic is to be stopped, the lights are switched on. Being set so as to be plainly visible to the driver, they give a vivid warning and are much more rigidly observed than the usual lamps, according to reports. The lights are flush with the pavement so they do not interfere with passing vehicles.

TWO-WHEELED MOTOR PULLS SLED THROUGH SNOW

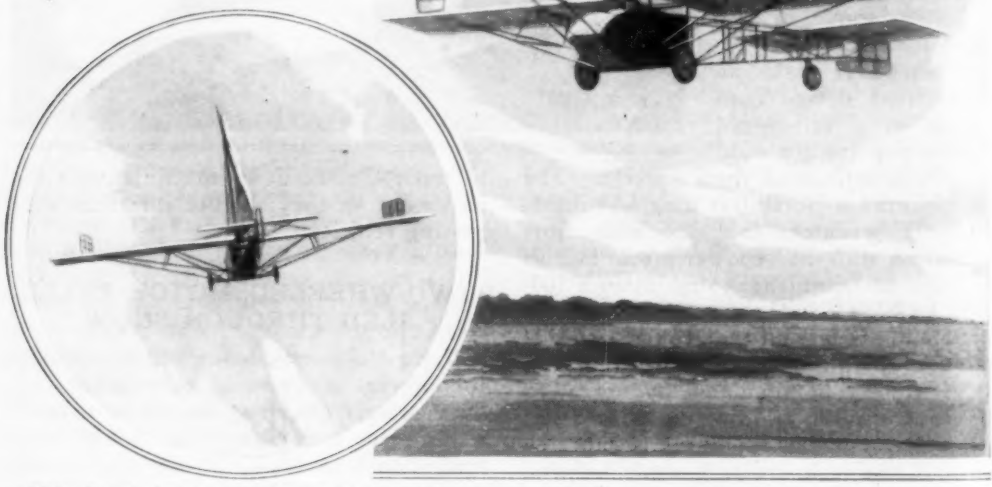
Using the engine of an old automobile for power, a Vermont man who does much winter traveling over snow-covered roads, has constructed a two-wheeled tractor to draw his sled. The engine was mounted on a pair of large, wide wheels, the power take-off being connected by chains to the wheels. The sled was large enough to haul a bulky load.



Two-Wheeled Homemade Tractor Used to Pull a Heavily Laden Sled over Snow-Covered Roads

GLIDER WITH SAILS DEPENDS ON WIND FOR POWER

After a year's experiment, a flight was recently made in a glider equipped with a sail to provide motive power. The sail is hoisted after the glider has been towed by an automobile until it rises. As a result of the successful tests with one sail, the inventor said that, with a mainsail and a jib, it will be possible to glide through the air, using the canvas for motive power.



Glider Provided with a Sail to Furnish the Motive Power; When Once Launched, the Craft Uses the Canvas for Power and Guiding Much Like a Sail Boat in Water

DIVERS AFTER PEARLS TRAINED FROM EARLY CHILDHOOD

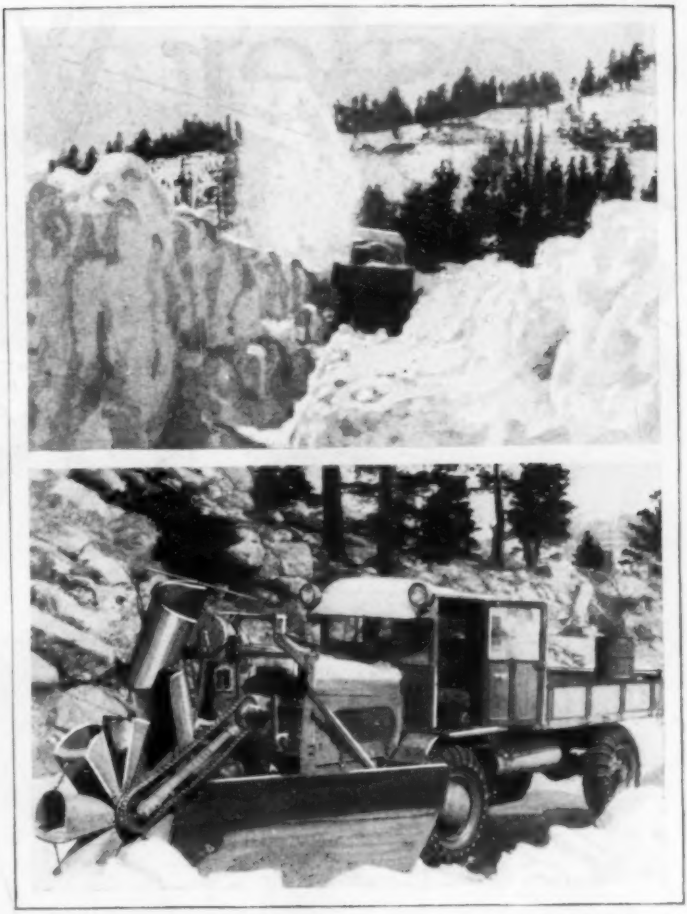
Pearl diving, searching for oysters on the ocean bed in 150 feet of water, requires training from childhood, and even then, the mortality rate is high. It has been estimated that there are 100,000 men who live by this hazardous means, virtually all being South Sea natives. The "skin divers" work naked, without armor, crews of them traveling together to the pearl banks. The diver's only equipment is a rope about his waist and an instrument, like a clothespin, to hold his nostrils shut. He stands on a large stone, fastened to another rope, and with the aid of this weight reaches bottom when helpers pull up the stone for the next descent. The diver walks about picking up pearl oysters which he places in a small basket. He has about two minutes in which to fill it, for three minutes is the maximum time he can hold his breath, even after years of practice. Besides the risk of staying down too long, the diver also is facing the danger of attacks by large fish and is constantly subjected to the terrific pressure

of the water which reaches seventy pounds to the square inch at 120 feet. A too sudden ascent may bring on the "bends," an affliction well known among caisson workers of civilization. It is a hard life with profits dependent on chance, and a short time ago a diver who brought to the surface a perfect pink pearl weighing fifty grains and valued at $250,000 went insane when he found how much his share of the profits would be.

KIDDIE CAR FOR USE IN WATER

To aid children in overcoming fear of the water, an aquatic kiddie car provides much sport and at the same time trains the youngsters to like the water. It has a canoe-shaped wooden frame that floats on a rubber tube resembling an automobile tire. The child is seated so that there is plenty of room for free movement of the legs in walking in the water or floating and kicking the legs. The tube is wide enough so that the craft cannot capsize. It is collapsible for ease in carrying to the beach.

An Aquatic Kiddie Car Consisting of a Wooden Frame Attached to an Inflated Rubber Tube



Rotary Snowplow Which Is Attached to Front of Four-Wheel-Drive Truck; It Makes Better Speed Than Tractor-Driven Plows

ROTARY SNOWPLOW ATTACHED TO FRONT OF TRUCK

Rotary snowplows that attach to the front of four-wheel-drive trucks instead of to tractors have been employed successfully by the California highway commission in clearing passes in the Sierra Nevada mountains. The truck-operated plow makes better speed and travels from snow bank to snow bank in better time than the usual tractor-driven plow, and the wheels of the truck do not break the roadbed as a tractor sometimes does. The plow is operated from the cab of the truck, swinging on a boom from side to side, the rotary wheel digging up the snow and throwing it against a deflecting plate which tosses it to the side of the highway, out of the way.

Easier Ways

This Safety Can Opener Fits on Table or Wall with Bracket, and Operates by Turning Crank

Knock-Down Furniture Is Not New, but This Is a Novel Application of the Idea to Upholstered Pieces; the Method Saves Shipping Charges and Reduces the Cost of Packing

Tomato Slicer Takes All Sizes and Cuts the Same Thickness

The Interlocking Fastener Strip at Left Is for Sewing onto Dresses to Eliminate Hooks and Buttons; at Right, a Dustpan That Has a Comb for Cleaning the Broom

# of Doing It

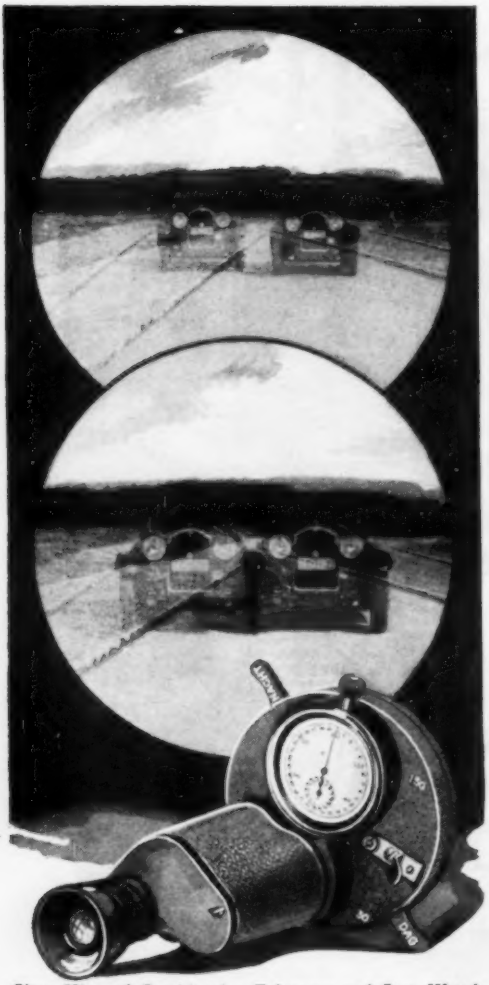
Slip Covers for Shoes, Rubbers and Slippers Prevent Soiling Clothing When the Footwear Is Packed in Trunks or Bags; They Keep the Leather from Being Scratched, and Fit Tightly

Combination Electric Dish Washer and Drier; It Supplies a Torrent of Suds for Washing; Breeze from an Electric Fan Does the Drying

Note Arrow Pointing to Slot in Edge of This Electric Iron; the Slot Permits Ironing under Buttons without Breaking Them

Holder for Nursing Bottle Is Easily Attached to Crib and Is Said to Insure a Steady Flow of Milk, Preventing Infant from Sucking Air; It Also Keeps the Bottle from Breaking

This Smoking Stand Is Balanced on Wheels so That It Can Be Rolled Away or Tipped



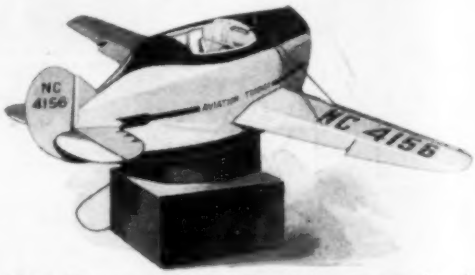
Close View of Combination Telescope and Stop Watch, and How Moving Cars Appear to Observer

TELESCOPE WITH STOP WATCH HELPS CATCH SPEEDERS

To detect automobile speeders, a Dutch police inspector has devised a combination telescope and stop-watch arrangement which can be operated night or day by one man, and is accurate to a degree not possible to the unaided eye. If a car is approaching at a speed that seems to be excessive, the observer levels the instrument and peers through the eyepiece of the blunt telescope. By means of prisms in the glass, two images of the car appear, one the true and the other a displaced image. The two images coincide after the car has run a certain distance. The stop watch is then started, the prisms are adjusted to produce two images once more and when they coincide again, the policeman stops the watch, notes the time recorded and, after measuring the distance between the middle of the tires of the car, which has been halted, is able to determine, with the aid of a set of tables, the exact time consumed by the car in passing over the distance involved between the first and second coincidence of the two images. This quickly enables him to tell whether or not the car was exceeding the legal speed limits. At night, the measurements and images are based on the lights of the car. Besides the accuracy and simplicity of the method, it has the added advantage of permitting the observer to remain in a concealed position.

FLY WITHOUT LEAVING GROUND IN COMPRESSED-AIR PLANE

All the sensations of flying are possible without leaving the ground with an aviation trainer, consisting of a small modified airplane mounted on a base containing pneumatic control apparatus. By means of compressed air, the plane, with standard cockpit, is moved about much as air currents affect ships in flight. The rudder bar and stick control other pneumatic pistons, which tend to counteract those moving the trainer, when properly manipulated. Thus the occupant, by moving the controls, tries to keep the plane on an even keel, his success being indicated by an efficiency dial. The controls are standard, and the sensation is similar to that experienced when a full-size plane is flying. While intended primarily as an aid in training student flyers, it is also suitable as an amusement device, a coin-operated attachment starting the motor that compresses the air.



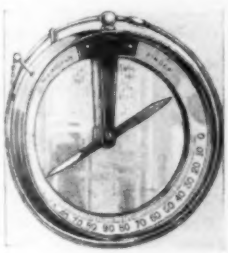
Plane Mounted on Base Containing Pneumatic Air Controls to Simulate a Ship in Flight

ALLOY AS LIGHT AS ALUMINUM AND AS HARD AS STEEL

Patents have been granted a Swedish engineer on an alloy that is as light as aluminum and hard as steel. It can be rolled, turned and drawn and is much stronger than aluminum. It resists alkaline lyes, and may find use in airplane, hydroplane and shipbuilding industries for hulls and propellers The alloy consists of aluminum and chromium which are placed in a high-frequency electric furnace where mixture of the two metals is effected by electrodynamic means.

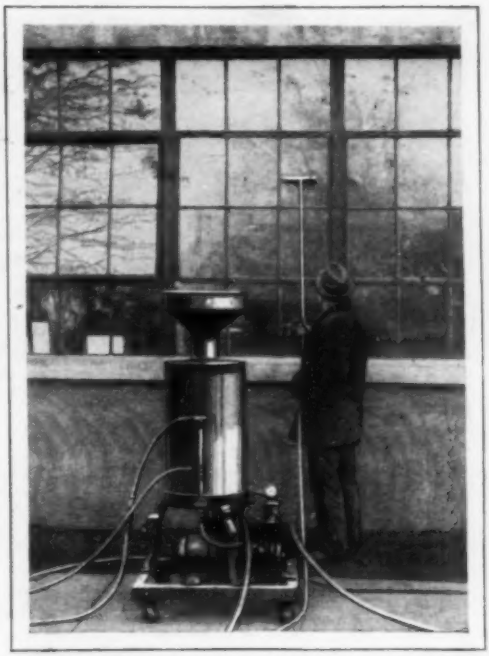
DIPPING-NEEDLE COMPASS FINDS IRON-ORE DEPOSITS

In the hands of the prospector, a miner's compass or dipping needle proves a serviceable guide to the location of magnetic iron-ore deposits. The magnetic needle is balanced on a horizontal axis within a circle graduated from zero to ninety degrees in quadrants. In reading the dip, the observer holds the ring in his hands, keeping the needle north and south, and facing west himself. The inclination of the needle as read on the scale shows the dip. Dependent on the geological formation and the experience of the observer, the needle aids in approximating the probable mass and depth of the ore from the surface. Held horizontal, it serves as a regular compass.



RUSSIAN PATENT OFFICE TO AID FOREIGN INVENTORS

For the handling of patent applications and patents in Russia and foreign countries, a patent concern, known as Pritz, Ltd., has been organized in Russia under government control. The patent office expects to aid foreign inventors who wish to exploit their products in Russia, to introduce Soviet inventions into state industries, and to acquire patent rights for the Soviet, and foreign patents in Russia and abroad.



Electric Washing Machine and Pump for the Cleaning of Large Windows and Skylights

ELECTRICAL WINDOW WASHER CLEANS AND DRIES

For the mechanical cleaning of windows and skylights, an electrical washer now is available. A water hose is connected to the machine, water being drawn from a tank by a pump that feeds it into the hose nozzle. Clear water is available for rinsing and a squeegee is attached for drying.

KNOTLESS TOWROPE FOR CAR IS EASILY ATTACHED

Appealing particularly to women drivers, an automobile towrope that is instantly fastened without knotting now is available. The ends of the rope terminate in ball-like knots and these are slipped through openings in the line near each end formed by weaving separate sections into the rope. The greater the pull exerted, the tighter the fastening becomes.

Garage Attendant Wearing Roller Skates to Help Him Speed Up Service to His Customers

ROLLER SKATES SPEED WORK AT GAS STATION

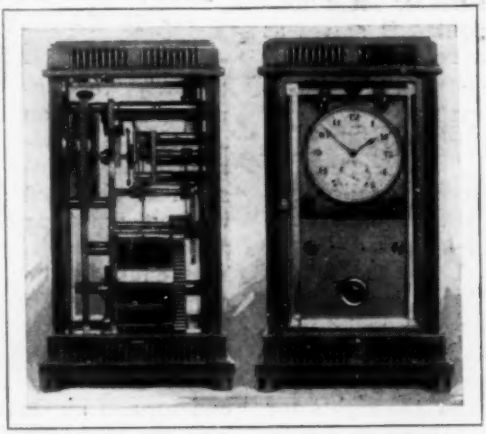
Employes of a Chicago gasoline-filling station have equipped themselves with roller skates to speed up the service to customers. Station attendants found that they made better time skating over the concrete driveway from car to car than walking.

ELECTRIC EYE GOES TO WORK IN OFFICE AND FACTORY

Photo-electric cells, the so-called electric eye used as the toy and tool of science, have been put to work in office and factory, performing many involved tasks with automatic and unerring accuracy through the medium of interruptions of a ray of light shining on the cells. In the steel industry, the cell is used to determine temperatures of steel in the blast furnace, the tube mill, or rolling mill, the eye detecting changes in brilliancy of the glowing metal that the human eye cannot discern. It also automatically operates the lighting systems in offices and factories, turning on artificial illumination as required when the intensity of natural light diminishes, and can be made to control street lights in similar fashion, turning on lights as required without waste. A beam of light thrown across a doorway will count persons entering a room, and the cell can be made to sort packages by detecting differences in appearance, and to operate a fire extinguisher as soon as smoke appears.

CLOCK WOUND BUT ONCE A YEAR KEEPS PERFECT TIME

Requiring only one winding a year, a small clock that keeps perfect time for that period owes its unusual feature to an invention enabling a small timepiece to run by a comparatively large force. Heretofore eight days has been about the maximum that a small clock could keep accurate time without rewinding, because when larger mainsprings were used for longer periods, the tension of the spring decreased as it ran down to such an extent that variation in the time resulted. The year clock, which can be made as small as two and one-half inches square, consists of an ordinary watch without the mainspring. The independent spring itself takes up most of the room because it must keep the clock operating for a year. Between the spring and mechanism are two miniature coil springs, similar to those used on screen doors, and a wheel which stretches them out when it turns. The large spring turns the wheel that stretches the small coil springs which constitute what corresponds to the mainspring of the ordinary timepiece. By increasing the size of the spring, the length of time between windings can be increased.



Small Clock with a Large Independent Spring Which Requires Winding But Once a Year

A Bigger Voice for Radio

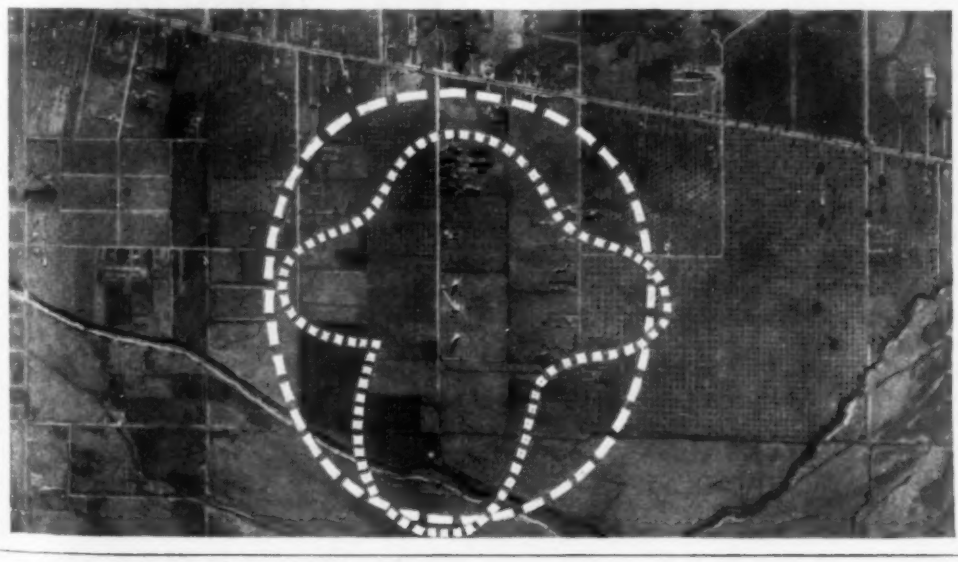
Courtesy Bell Telephone Laboratories

The Flying Laboratory of the Bell Telephone Company Winging Its Way over Long Island; Note the Mast-Type Antenna behind the Wing of the Fuselage

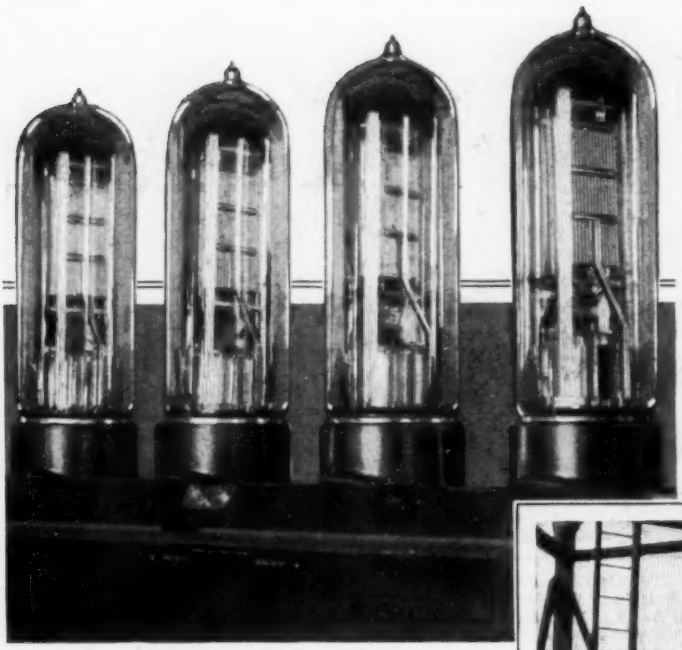
WHEN you turn the dial to your favorite broadcasting station, and the program comes through all mixed up with whistles or fades just when it is becoming most interesting, who or what is to blame?

More than likely, you criticize your set, or perhaps you complain about some interference in the neighborhood. While it must be admitted that some receivers are not as perfect as they might be, the real trouble is mostly at the sending end, in the opinion of Arthur O. Austin, of Barberton, Ohio, an authority on high-frequency electrical currents.

While your favorite broadcasting station is an excellent example of the progress made in radio science, nevertheless there is much room for improvement.

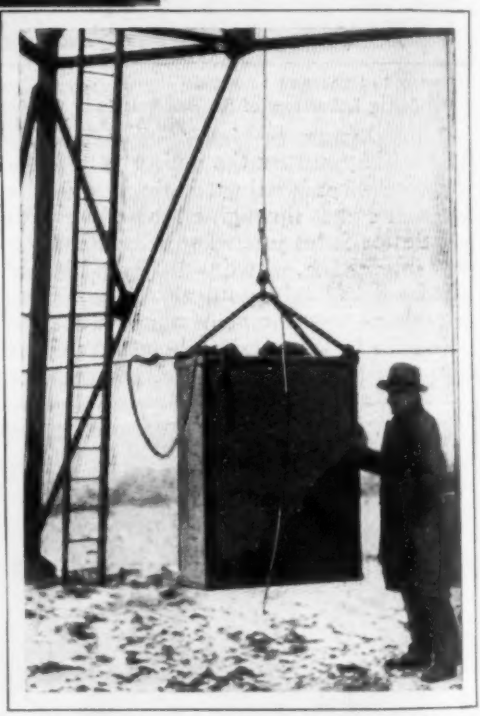


Country Surrounding KNX's Transmitter as It Appears from the Air; the Clover-Leaf Pattern Indicates Field Before New Insulators Were Installed; the Outer Line Shows Effect of the Change



listener's set is about the same as that required by a fly in climbing an inch or so up a window pane.

After years of trailing radio troubles in broadcasting stations, engineers have brought to light an important fact. It is, simply, that large masses of metal, like the towers that hold up antenna wires, or the steel framework of the building on which the station is situated, are set into electrical vibration, or oscillation, whenever the station operates. They absorb part of the station's energy and send out waves of their own.



Tubes in the New Transmitter, and One-Ton Counterweight That Holds Down Antenna End

The sending wave of many stations carries with it a lot of straggler waves which spread out and rub elbows with other programs in near-by channels. This lack of sharpness in the main is the cause of imperfections not only in its own program but also in those of other stations. Overlapping of the straggler waves causes whistles and other noises.

The presence of whistles in a program does not mean, necessarily, that other stations are wandering off their assigned paths, Mr. Austin points out, but it is an indication that they are sending out more than one wavelength, the fundamental one and a lot of extra ones that do nothing but make trouble. You can get a clear picture of this by tossing a large stone into a pond of water, and then throwing several small pebbles after it. The large stone will set up a train of waves, but the perfect form of these waves is destroyed by the smaller waves created by the pebbles.

The largest broadcasting stations in this country use 50,000 watts for regular work. Fifty kilowatts of electricity is equivalent to sixty-seven horsepower—more than the majority of automobile engines develop—yet the amount of power received at the

But perhaps by listening to Mr. Austin you can get a better idea of this condition:

"Any radio tower," he says, "has a natural period of electrical vibration. If it oscillates slower or faster than the sending-wave frequency, it will cause inter-

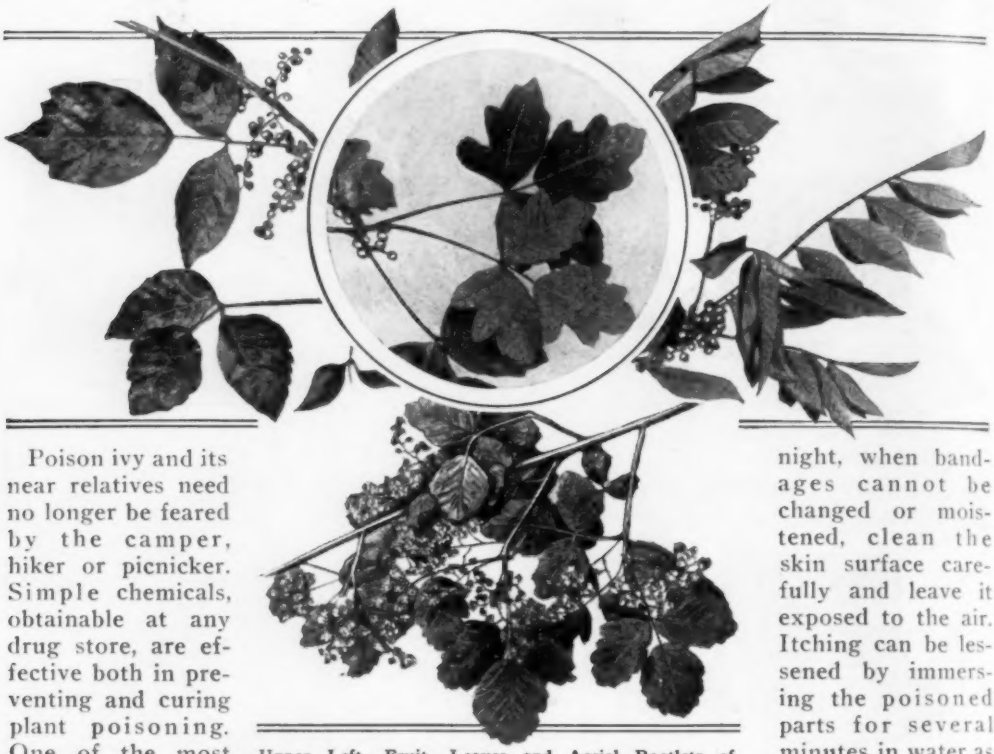
Insulators for the Towers to Improve Operation and View of Tower Showing It Insulated in Sections

ference, and may be said to 'cast a shadow.' If you could fly above the towers and see this electrical shadow, you would notice that it takes a shape somewhat like a figure '8' in many cases. The shape would indicate how the energy was being distributed about the station."

Years ago, during the World War, Mr. Austin started to solve the radio-tower problem. In helping the navy, he worked out the principle of the sectionalized tower. This consists, essentially, of a steel tower that is cut up into sections, each of which is separated from the other by a set of porcelain insulators. Thus, instead of there being one single tower, there is really a stack of small towers, one above the other. The war ended before the navy stations were built, and Mr. Austin's sectionalized towers were forgotten, temporarily.

Then station WHK, Cleveland's pioneer broadcaster, decided to build a new sectionalized transmitter. Although hampered by a power restriction to 1,000 watts and a low wavelength, the station is now being heard in Honolulu, New Zealand and all over the United States, achieving results that in some instances are comparable to those of its super-power brothers and it is hoped that it will be able, some day soon, to try out its new equipment with much higher power. Plans are under way for other transmitters of this type, probably modified to consist of a single tower, itself acting as antenna.

YOU NEED'NT FEAR POISON IVY—IT'S EASY TO CURE



Upper Left, Fruit, Leaves and Aerial Rootlets of Poison-Ivy Branch; Circle, Oakleaf Poison Ivy; Right, Poison Sumac; Below, Branch of Poison Oak

Poison ivy and its near relatives need no longer be feared by the camper, hiker or picnicker. Simple chemicals, obtainable at any drug store, are effective both in preventing and curing plant poisoning. One of the most successful remedies for oak, ivy and sumac poisoning is a five-per-cent solution of potassium permanganate in water, according to Dr. James F. Couch, poison-plant expert of the department of agriculture. The solution is applied to affected portions of the skin with a bit of absorbent cotton. The potassium salt destroys the poison, and its only effect on the skin is to leave a brown stain that can be removed easily with a one-per-cent solution of oxalic acid or sodium bisulphite. If the skin is too tender for treatment with these chemicals, several washings with soap and water will remove the stain. Oxalic acid is a poison, and should be kept away from the mouth. Inflammation caused by ivy poisoning can be helped by such simple remedies as local applications of Epsom salt or baking soda (sodium bicarbonate). Use one or two heaping teaspoonfuls to a cup of water. The solutions are best applied with light bandages of clean cloth, kept moist and changed frequently to avoid infection. During the night, when bandages cannot be changed or moistened, clean the skin surface carefully and leave it exposed to the air. Itching can be lessened by immersing the poisoned parts for several minutes in water as hot as can be borne, or by applying hot towels. The itching increases during the treatment, but is followed by great relief. In early poison stages, do not apply oily or greasy preparations, as these tend to spread the poison. Later, when the poison material has been exhausted, zinc-oxide ointment or a similar astringent or antiseptic of mild nature can be used. These remedies are for cases of actual poisoning, after inflammation has appeared. Much trouble can be avoided, however, by employing simple preventive methods. After returning from a hike, wash the exposed portions of the body several times in soap and water, and rinse thoroughly.

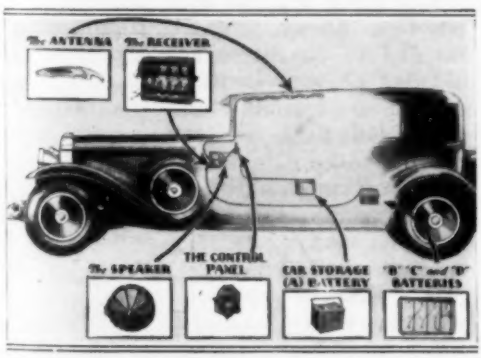
Dr. James B. McNair, of the Field Museum, Chicago, has found that a solution consisting of five parts of ferric chloride in ninety-five parts of a half-and-half mixture of water and glycerine will prevent poisoning if applied to the skin before embarking on a trip in ivy-infested regions. Or one part of ferrous sulphate in five parts of water can be used. These

solutions are applied to the skin and allowed to dry.

Poison-ivy plants are most easily recognized by their leaves, which always are divided into three leaflets. The fruit is a whitish, waxlike berry that stays on far into the winter, after the leaves have disappeared. Young leaves are a glistening red, becoming green as they grow older. For persons not well acquainted with poison ivy, a safe rule is contained in the saying, "Leaflets three, let it be."

CONCEALED RADIO FOR AUTO IS EASILY INSTALLED

Installation of a recently produced radio set for the automobile is a comparatively simple matter, only a little more involved than placing a similar set in the home, and, when the job is completed, all parts are concealed except the control panel on the instrument board. The antenna is installed in the roof of the car, ordinarily consisting of a copper screen, although sometimes a special installation is necessary for the open car. The receiver is located on the engine bulkhead, below the cowl, and the speaker is carried on the receiver case, beneath the cowl, although it may be placed in other positions. The car's storage battery is used for the A-supply, and a battery box beneath the floor carries the dry batteries for B and C-supply. Eliminator units are installed, if necessary, to stop interference from the various electric devices on the



Showing Method of Installing Concealed Radio Set in Auto; Only Control Panel Is Visible

car. The control panel is equipped with automatic volume control, and with a switch operated with a key.

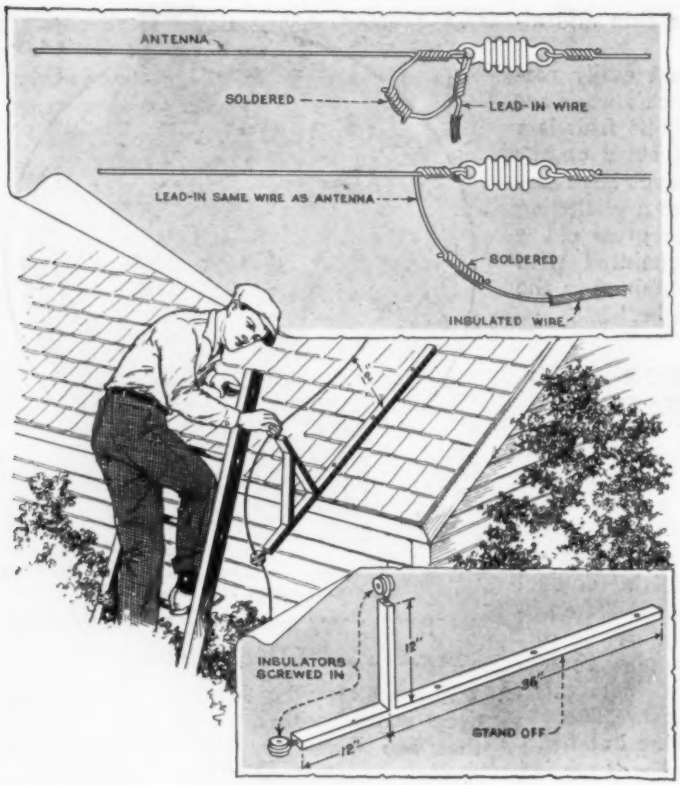
Rubber Waders, Worn as Trousers, for the Angler Who Likes to Venture into Deep Water

RUBBER WADERS FOR ANGLERS WORN LIKE TROUSERS

For anglers who desire to venture into deep water, rubber waders are supplied that are worn like trousers and allow wading waist-deep. They can be worn over or inside shoes and are equipped with a waterproof pocket in front. The material is as light and pliable as the cloth of an ordinary garment.

HYDRAULIC DRIVES FOR TOOLS

German tool builders are experimenting with hydraulic drives for certain parts of machine tools, and have found them much more simple for the tables of planers and the heads of slotters and shapers than the trains of gears and other mechanical motions usual for such machines. Hydraulic drives for these parts make possible uniform and controllable speeds without vibration, greater output and automatic safeguard against breakage because of the impossibility of exceeding the designed pressure on the tool. Reversal, as in the case of planer tables, is effected silently and definitely, with no screeching of belts or rumbling of gears. During the war, an English tool builder operated the carriages and tool slides of heavy lathes by simple hydraulic cylinders, and the principle is coming into favor again.



Bringing In the Antenna Lead

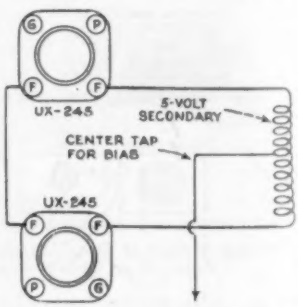
Every experienced DX-listener knows that a carefully installed antenna is quite necessary in order to log distant stations. One point in the usual antenna installation that is frequently the cause of poor DX-reception is the careless manner in which the lead-in is brought down to the set. The lower sketch shows a simple stand-off bracket that anyone can make and a method of installing it which may be applied to any type of roof. A good soldered joint at the point where the lead-in wire is connected to the horizontal portion of the antenna is essential. If possible, make the lead-in and the antenna proper all from the same wire, extending it clear down to the antenna binding post on the set. If this is not practical with the materials on hand, make the connection as shown in the upper sketch, placing the strain of the horizontal portion entirely on the insulator. The twisted leads should be scraped and filed bright before the solder is applied to the joint.

Curing Dynamic Speaker of Rattle

A little kink which has been found very useful in working with dynamic speakers has to do with loose turns in the voice coil. This condition may cause a great deal of trouble, as it makes the speaker rattle. The remedy is very simple. First remove the cone from the speaker unit, which may be done by taking out the bolts that hold the cone assembly to the field; then unsolder the leads to the voice coil from the transformer in the frame. This will expose the coil so that the loose turns of a wire can be located. Get a tube of good household cement and apply it freely to the coil. Use the fingers in doing this and be careful not to leave any high spots to hit the collar of the field magnet.—James E. Whitney, Wenatchee, Washington.

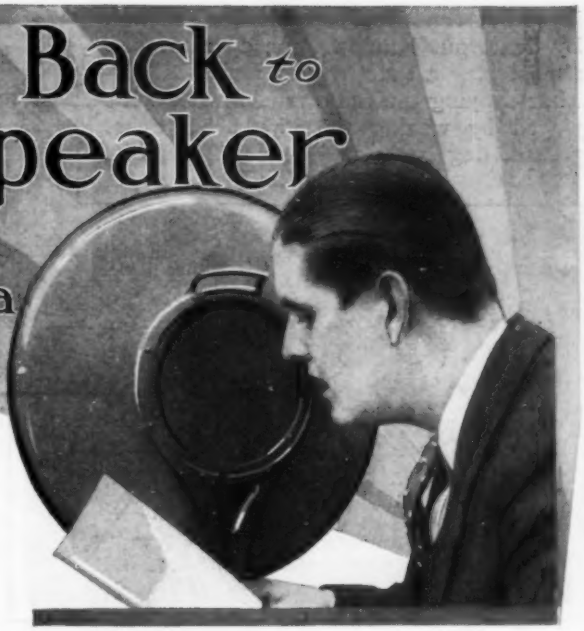
Power Tubes Operate in Series from Five-Volt Tap

The writer recently desired greater output from an a.c. push-pull amplifier and decided to substitute 245 tubes for the 171-A type then in use. Not having an extra 2.5-volt winding on the transformer, I decided to connect the filaments of the 245 tubes in series and work them off the 5-volt winding provided for the 171-A tubes. This was done in the manner shown and worked out nicely.—Ross J. Plaisted, Cleveland, Ohio.



Talking Back to the Loudspeaker

by Austin C. Lescarboura



WHO ever thought of talking back to the loud speaker? A speaker is made to talk and not to listen, and yet it is possible to talk back—and here's how:

Any loud speaker can be employed as a microphone. While it is relatively insensitive, as compared with the carbon or condenser microphones now employed for broadcasting, the speaker will handle the close-up voice quite nicely. For this purpose, an additional speaker should be employed and attached to the radio set or amplifier, to serve as the pick-up in place of the usual radio-receiving circuit and detector.

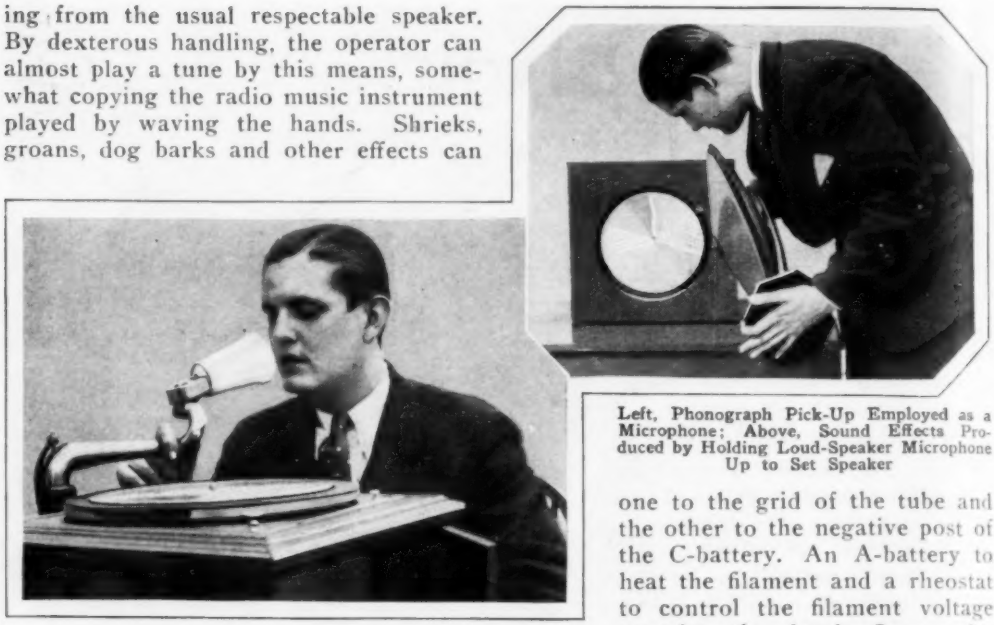
There are different methods of cutting in the loud-speaker microphone, depending on various factors. In the case of a radio set provided with a phonograph jack or pin jacks, the loud speaker is simply connected in place of the phonograph pick-up. In the case of an ordinary radio set, the loud speaker may be connected between the grid and the filament or cathode, with the set detuned so as not to conflict with the loud-speaker pick-up. In the case of a power amplifier, the speaker may be connected to the input of the first stage. A little experimenting will soon indicate the best place to cut it in, following the foregoing general suggestions.

The most sensitive type of loud speaker for use as a microphone is the concealed type, or concave diaphragm in a baffle-plate and box. If a person talks directly into the diaphragm, quite close up, the sensitivity is remarkable, although the tone reproduced in the loud speaker of the radio set will be rather tubby and even muffled. For better tone quality, with some loss of sensitivity, the speaker should talk at the diaphragm from the side, so as to eliminate the hollow effect.

The double-diaphragm type of loud speaker is remarkably sensitive if talked to from the rear, through the usual opening covered with a screen, as shown in the upper photo. The talking is reproduced in a tubby fashion, but rich and deep. If a higher-pitched voice is desirable, the loud speaker should be talked at from the front, preferably close to the center drive pin, which is the most sensitive area.

It will be noted during such experiments that the loud speaker occasionally groans and howls, sometimes to the point where the loud speaker employed for the microphone cannot be used in the same room. This is due to the acoustic and electrical coupling existing between both loud speakers. If the microphone loud speaker is taken to a far corner of the room, or if it is moved in different directions or sometimes even tilted horizontally, the howling may cease. This very handicap may even be put to use for an amusing experiment. If the second or microphone cone is brought close to the receiver loud speaker, there will be the most awful shrieks imaginable, emanat-

ing from the usual respectable speaker. By dexterous handling, the operator can almost play a tune by this means, somewhat copying the radio music instrument played by waving the hands. Shrieks, groans, dog barks and other effects can be obtained. By rocking the microphone speaker in one's arms, a most unusual lullaby can be produced, to the edification of all present.



Left, Phonograph Pick-Up Employed as a Microphone; Above, Sound Effects Produced by Holding Loud-Speaker Microphone Up to Set Speaker

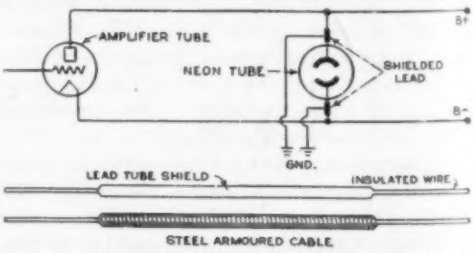
The electromagnetic pick-up may also be employed as a microphone. All that is necessary is to fasten a piece of stiff paper, folded in half to form a V-shaped trough, on the usual needle. By talking into the paper "V," when the pick-up is connected with an amplifier or receiving set, the operator may become his own announcer. A paper cup also serves as a microphone when fastened to the needle of the phonograph pick-up.

Laboratory Voltmeter Employs Tube

Even the most delicate of the usual types of voltmeters and milliammeters require some energy to actuate their mechanisms and are unsuitable for measuring the very minute signal voltages and currents in the grid and plate circuits of a radio receiver. For such use, the vacuum-tube voltmeter is very efficient and has the added advantage of being very simple and inexpensive. It consists of a CX 301-A tube with an accurate low-scale milliammeter, a B-battery in the plate circuit and a C-battery in the grid circuit. Two terminals are provided in the latter, one to the grid of the tube and the other to the negative post of the C-battery. An A-battery to heat the filament and a rheostat to control the filament voltage complete the circuit. In practice the input grid-circuit terminals are connected in the circuit whose voltage is to be measured, and the current in the plate circuit is read on the milliammeter. The voltage in the grid circuit can then be determined by consulting the calibration chart of the tube voltmeter.

Shielding of Neon-Tube Leads Improves Television Pick-Up

The detector and amplifier circuits of a radio receiver used in television work are, in a measure, affected by the action of the neon tube used in the scanning section. Sometimes this seriously affects the clarity and definition of the image frequencies impressed on the pick-up circuits. It has been found that, by shielding all the leads running directly to the neon tube and grounding such shielding, the pick-up



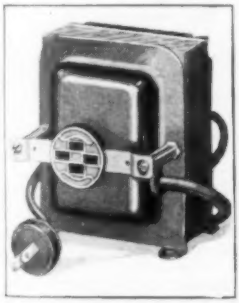
Above, Diagram Shows Position of Wire Shields in Circuit; Below, Methods of Shielding Leads

is considerably improved. The diagram indicates just where these leads are and how they are shielded. If the user can obtain small lead tubing and introduce the neon leads through it, an almost perfect shielding can be obtained. Instead of this, a small steel-shielded cable can be used with almost as good results, although lead is to be preferred. Ground each and every bit of shielding as shown.

Broken Sockets in Power Packs

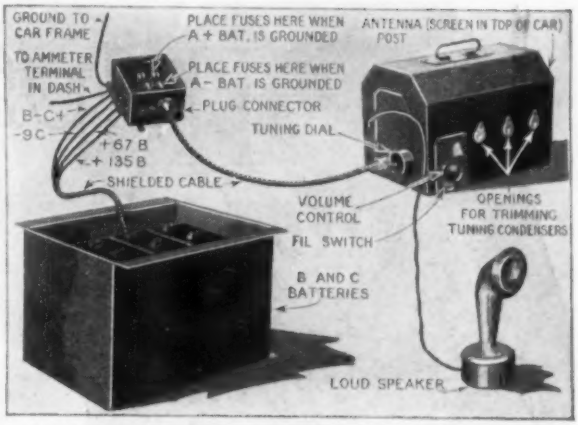
Old UV-type vacuum-tube sockets are useful for replacing broken sockets in power packs, where rectifier tubes of the 280 or 281-type are used. A socket for this use need not be of the cushioned variety and one of the old-type sockets serves the purpose nicely. Sockets having metal tops are preferable to the molded types, owing to the heat generated by the rectifier tubes.—R. J. Plaisted, Cleveland, Ohio.

High Line Voltages Reduced for Standard A.C. Sets



A step-down 50 to 60-cycle transformer is designed particularly for standard receivers to be exported to foreign countries where 110-volt current is not common. This transformer is said to have a core loss of but 6 watts with a temperature rise of less than 20° C. The capacity is 150 watts and the step-down range is from 220 and 240 volts to 110 and 120 volts. The above specifications make the transformer ideal for use in warmer climates. It comes complete with plug, cord and bakelite receptacle, all ready for mounting in the cabinet.

¶For further information on any radio construction article write to the radio department; this service is free.



Installation Diagram, Showing the Various Units and Cabled Connections of the New Receiver for Autos

Kit Makes Auto Receiver

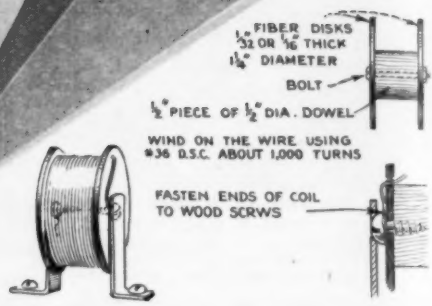
A series of newly designed parts for the construction of an automobile radio receiver has recently been announced by an eastern manufacturer. These include the chassis frame and suspension hardware, control panel, terminal block, battery box and special speaker to be mounted behind dash. Five tubes are used, three 224 heater-type screen-grids, and two 112-A. The tubes are arranged with filaments and heaters in series-parallel so as to minimize the drain on the storage battery. The circuit has two stages of screen-grid r.f., power detector screen-grid resistance-coupled a.f., and 112-A power-output stage.

Photoelectric Cell of Rugged Construction

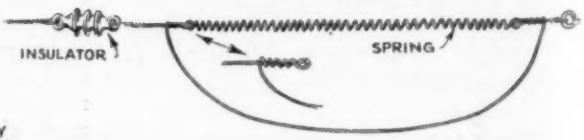
A "wet" photoelectric, or rather "photolytic," cell is now available which combines the sensitiveness of the vacuum or gas cell and the ruggedness of the liquid cell. It is said to be very stable and efficient over the light-intensity ranges employed in sound-reproduction systems. Its low impedance lends itself to the design of a practically distortionless reproduction circuit.

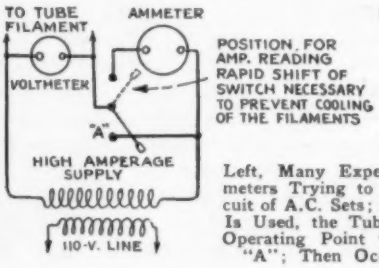
Helpful Hints

Noisy Microphonic Tubes Are Easily Located by Lightly Tapping Each Tube While the Receiver Operates

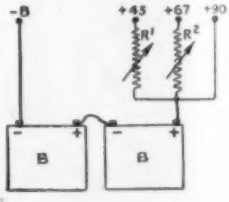


Small Choke Coils Suitable for Modern Circuits May Be Conveniently Mounted on Short Metal Brackets; Below, Screen-Door Spring Used to Take Up Antenna Strain; the Wire Loop Prevents the Antenna from Falling if the Spring Breaks





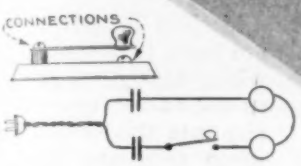
Left, Many Experimenters Have Ruined Their Ammeters Trying to Connect Them in the Filament Circuit of A.C. Sets; to Do This Safely, the Switch Shown Is Used, the Tubes Being First Allowed to Heat to Operating Point with the Switch Lever in Position "A"; Then Occasional Readings May Be Taken



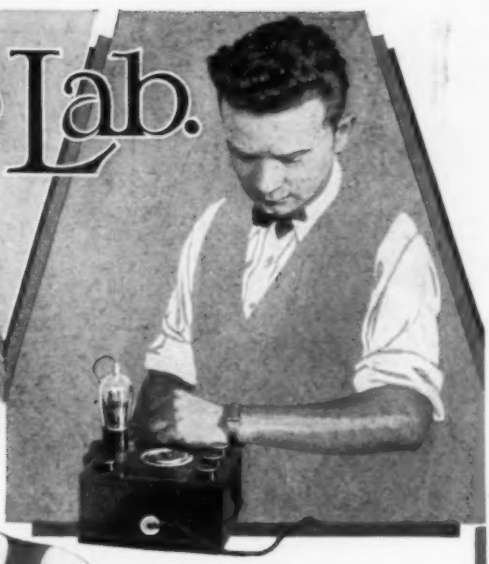
Right, Voltage-Divider Principle Applied to Battery-Operated Sets Equalizes Drain; R^1 and R^2 Are Graphite-Path Variable Resistors, Either 250,000 or 500,000 Ohms

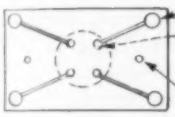
Left, a Pendant Switch and a Length of Lampcord Extending from the Radio Receiver to the Telephone Form a Time and Patience-Saving Device, As It Is Usually Necessary to Turn Off the Set When the Phone Is in Use; the Switch Is Merely in Series with One Lead of the A-Battery or in One Side of the A.C. Supply Line to the Set; Below, Taking A.C. Line-Voltage Reading with Meter Equipped with Test Prods; Partly Withdraw Attachment Plug from Wall Socket as Shown

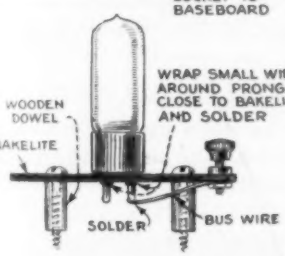
from the Radio Lab.



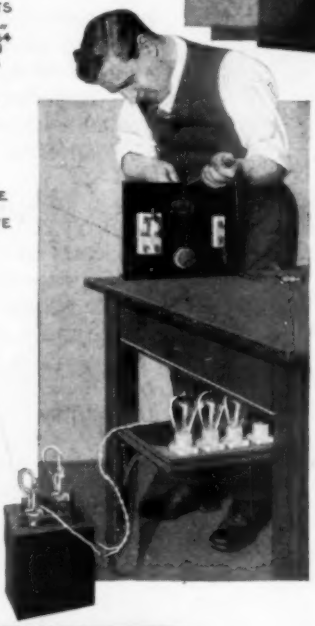
Code-Practice Device, Utilizing Line Hum Instead of Buzzer; Right, Heating A.C. Tube Filaments a Full Minute before Testing



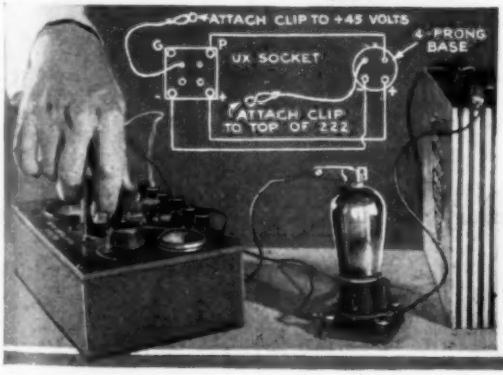


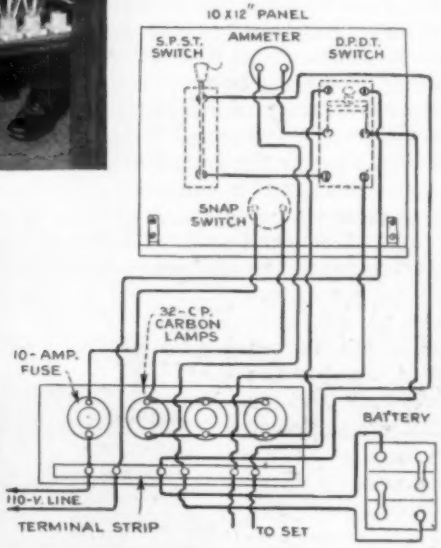


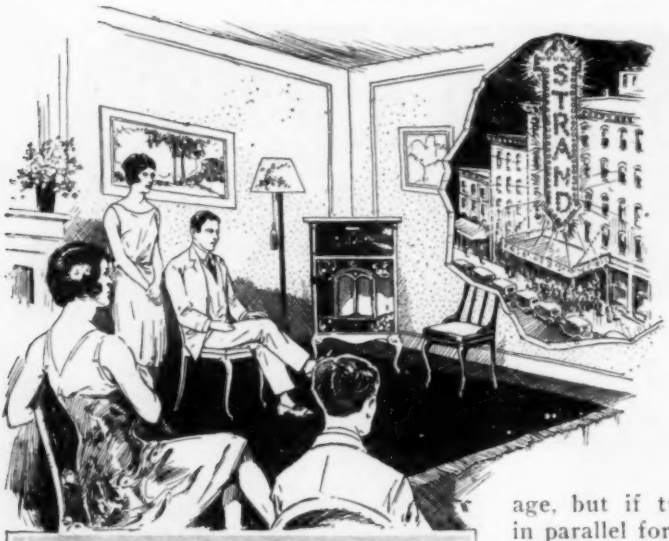
Above, Mounting Tubes without Using Spring-Clip Sockets; the Leads Are Soldered Directly to the Ends of the Prongs; Below, Testing Type-222 Tubes for Plate Current with an Ordinary Tube Tester; a Tube-Base Plug and Extra Socket Are Required; Be Sure Filament Voltage Is 3.3 Volts

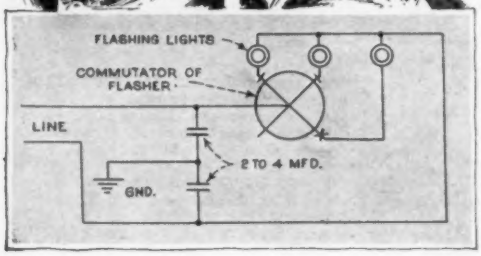


A Handy Layout for Charging Radio Batteries from a 110-Volt D.C. Line; the Lamps Are in Parallel and Connected in Series with One Side of the Supply Line and the Battery, as Will Be Noted by Tracing One of the 110-Volt Leads with the Large Switch Up; the Ammeter Is an Auto-Dash Type; Test and Mark Leads to Battery for Polarity before Connecting; if Ammeter Shows Discharge, Reverse Ammeter Leads; the Small Switch Is Always Opened for Safety When Charging, and Snap Switch Turned Off When Battery Current Is Going to Receiver









Method of Suppressing Interference Caused by Flashing Signs

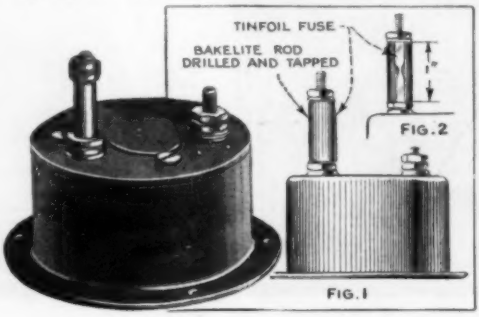
The method illustrated in the diagram will be found effective in reducing the disturbing interference from flashing signs, and may be installed by the owner of the sign at small cost. The filter-type condensers used must be rated for a working voltage in excess of 300 volts. The two condensers are connected in series across the line, as near the interfering device as possible, the middle connection between the condensers being taken to ground as shown. A power-line filter between the a.c. receiver and the wall plug will still further reduce interference of this type, which is often picked up by the power lines and fed to the set, the power line acting as an antenna. A line filter that will suit this purpose was described in detail in the May issue of this magazine.—Ross J. Plaisted, Cleveland, Ohio.

Extending the Life of B-Batteries

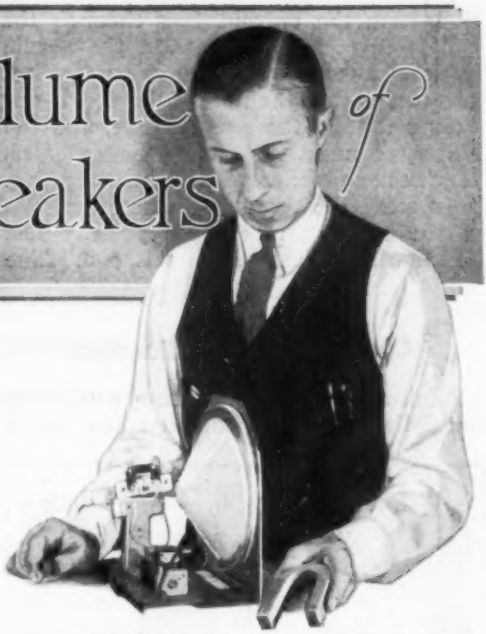
Modern B-batteries do not seem to cause noises when nearly exhausted, as did earlier types. At any rate this is the fact when they are quickly run down by a large set. In this condition they have a high resistance and cut down the voltage, but if two of them are connected in parallel for each 45-volt unit, they can be used as long as the voltage is high enough to operate the receiver. If several batteries in the same condition are available they may be connected in parallel series to obtain the high voltage.

Tinfoil Fuse Protects Meter

Meters used by radio experimenters are rather expensive and should be protected with a suitable fuse in case a short occurs in the radio circuit. A mounting for this purpose may be made by drilling and tapping a short piece of bakelite rod from end to end and screwing it on one of the meter binding posts as shown. A threaded brass rod, with suitable nuts and washers, provides the insulated circuit terminal at the opposite end of the bakelite rod. A narrow strip of tinfoil, cut as shown in Fig. 2, is then placed on the outside of the insulated section and held in position by screwing the nuts tight against it at both ends, to provide a good electrical connection. The foil fuse should be cut as narrow as possible without blowing out on a normal load. If bakelite rod is not available, a wooden dowel may be used, provided it is first boiled in paraffin to remove all trace of moisture.—R. J. Williams, Chicago.



Boosting the Volume of Magnetic Speakers



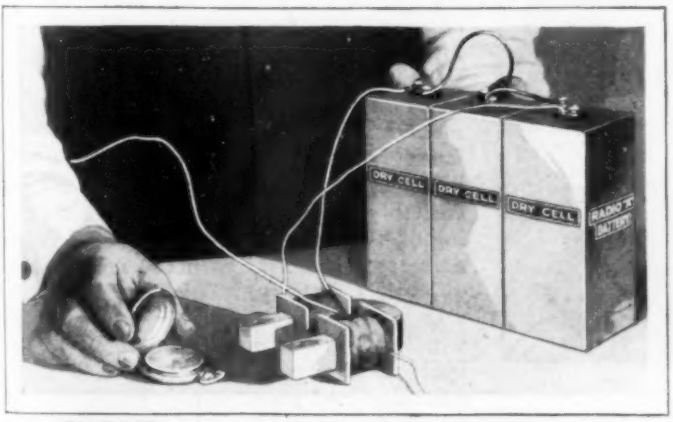
Removing Magnet from Cone-Speaker Assembly

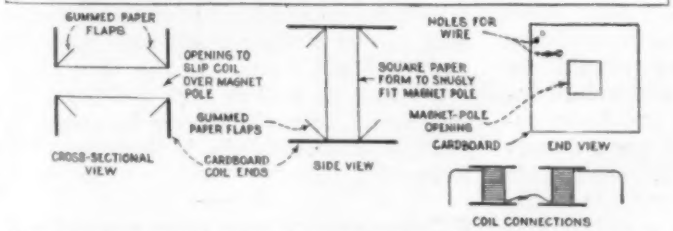
HOW would you like to increase the volume of your present magnetic speaker? Many radio fans who cannot afford a dynamic speaker will appreciate the results obtained from their old speaker with the addition of two field coils.

Magnetic speakers of the popular types have a large permanent magnet to furnish the flux. As the clearance between the magnet and the speaker coil is at least 1½ in., there will be plenty of room to mount the field coils, which are wound on the magnet legs.

The coils, wound with No. 20 gauge s.c.c. enameled wire, require 350 turns on each magnet leg to permit operation on three dry cells.

The best way to build the coils is as follows: Make a cardboard form, as shown in the sketch, holding the core form and the ends together with gummed paper. After the form is completed, slip it over a small block of wood, that fits snugly in the core opening, and into the end of the block pound a nail which is clamped in the jaws of a hand drill, to permit fast winding of the coil.





Above, Checking Field-Coil Polarity in Respect to Magnet Pole; Below, Coil-Construction Details

After the coils are made, they should be painted with black asphaltum paint and allowed to dry overnight, then placed on the magnet legs. Then you are ready to connect them.

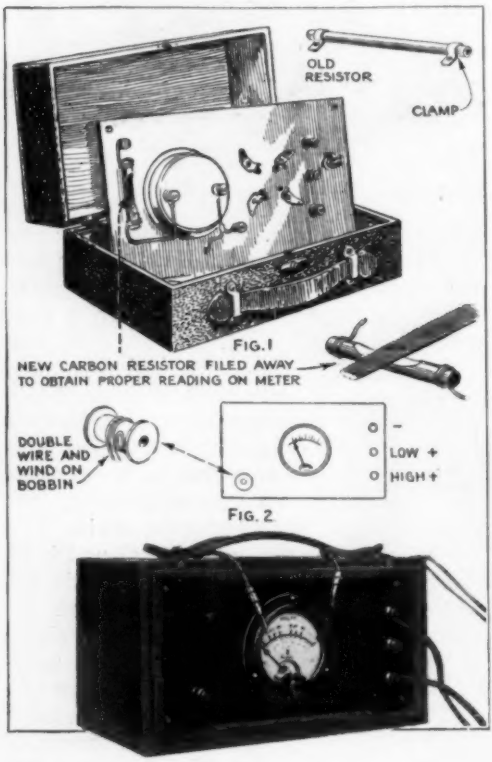
Get a small compass and hold it near one of the magnet poles. If this is the "N"-pole of the magnet, naturally the "S"-pole of the compass needle will be attracted to it, and the needle will rest in this position. Now connect this single coil to the battery. If the needle retains its posi-

tion, then the current flow through the coil is correct. If, however, the needle is kicked away when the current is applied, this means that the flux of the coil is opposing that of the magnet pole, and the battery connections should be reversed. Mark the coil leads positive and negative. Now move the compass to the other pole of the magnet, repeat the polarity test and mark the leads from this coil. The two coils are then connected in series, positive to negative, so that the current flow through them will be in the same direction as when they were tested, and the coil field will assist the magnet field.

Many speaker units that have been discarded, due to poor magnets, can be restored to normal operation by using the foregoing method, and your present speaker can be increased in volume.

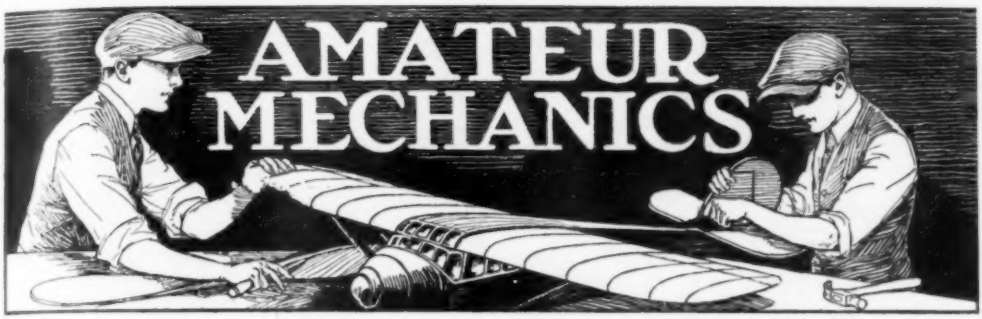
Checking Service Voltmeters

High-resistance voltmeters employing multipliers are now common and, when



new, are usually accurate. This, however, is not always a permanent condition and the meters therefore should be checked at intervals with a standard instrument. The writer has had some experience with a number of good meters that were equipped with multipliers made of coated glass, contact being made to the resistant material through metal bands. After a time in service or lying on the shelf, the meters were found to be from 20 to 100 volts out of line on a 500-volt scale. The instrument was labeled 1,000 ohms per volt, the resistance of the instrument with the multiplier being 1,000 times 500 volts, a total of 500,000 ohms. Removing the old resistor, which was tagged 490,000 ohms, a 500,000-ohm 1-watt carbon resistor was substituted for it. In this case, the resistor selected gave a reading slightly higher than standard. The meter was connected to the output of a B-eliminator in parallel with one of known accuracy, and the carbon was then filed, as shown in Fig. 1, until both meters read alike. This is an easy way to make a resistance fit a particular case. A double-scale meter of good make was purchased from a salvage house; this meter was accompanied by an external resistor for the high-range scale of 250 volts, but none for the low-range scale. With this material to start with, a very handy instrument was assembled as shown in Fig. 2. Enough wire was unwound from a bobbin-type resistor, salvaged from an old electrolytic B-eliminator, to give a reading of 4½ volts on the second scale when connected in series with the meter and a 4½-volt C-battery. This length of wire was doubled to make a noninductive winding when wound on a small wooden spool, as shown in the sketch. The meter was mounted on a rubber panel and installed in an old leather-covered camera box. Four binding posts were provided, and, with a C-battery in the case, continuity tests as well as high and low readings could be made merely by switching the test leads.—Edwin J. Bachman, Fullerton, Pa.

¶Defective rectifying tubes cause distortion and weak signals.

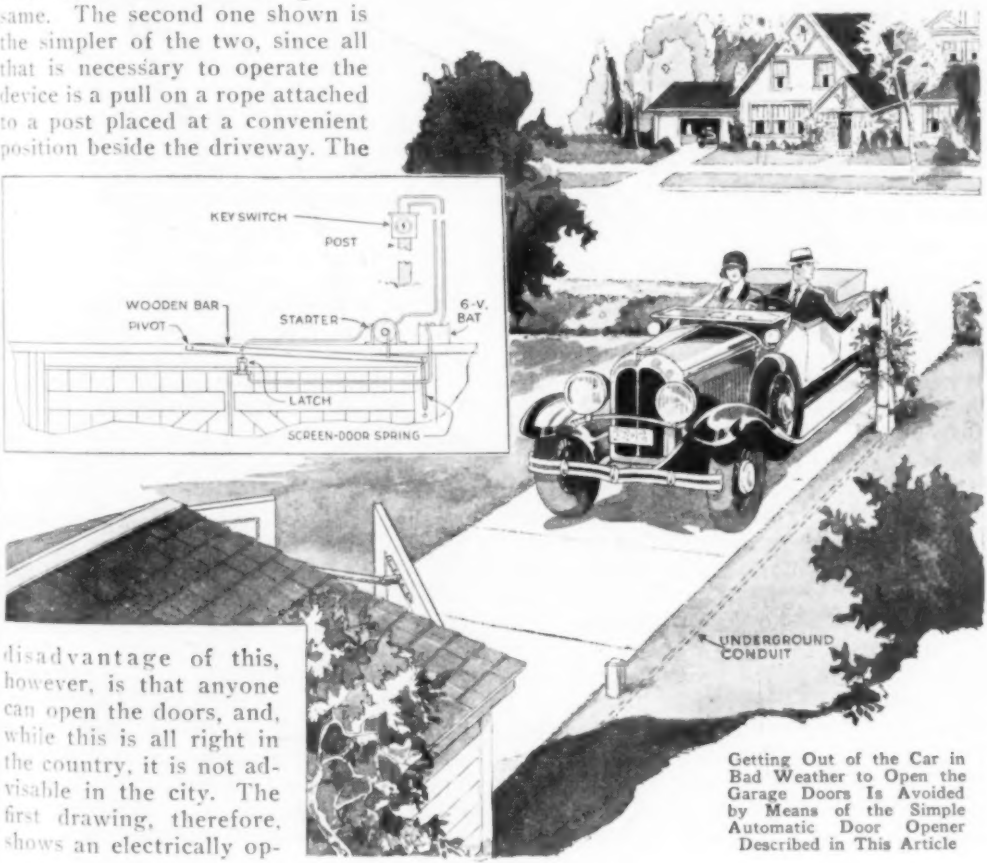


Garage Doors Opened from Car

By GEO. M. HURD

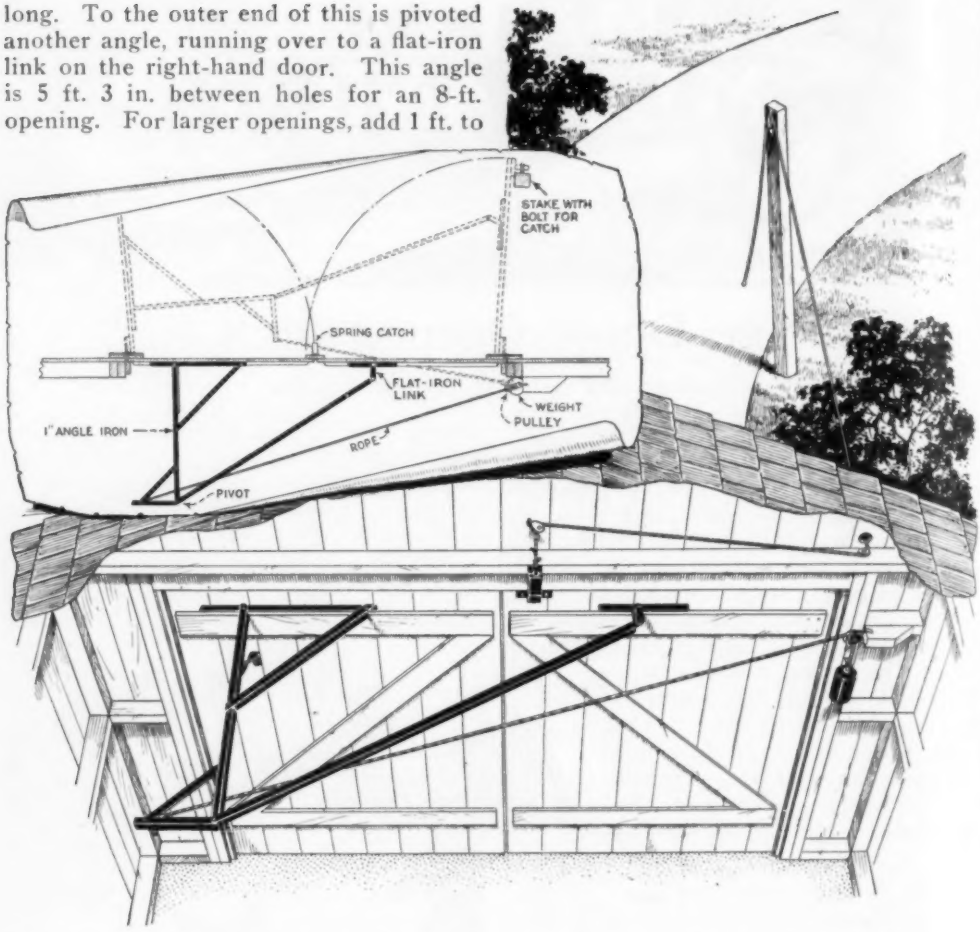
MOST of us object to getting out of our cars in order to open the doors of the garage, especially in bad weather, and the drawings show how this can be avoided. The mechanism is simple, and can be made and attached to the doors by anyone handy with tools. Two forms of the device are shown, the opening mechanism in both being the same. The second one shown is the simpler of the two, since all that is necessary to operate the device is a pull on a rope attached to a post placed at a convenient position beside the driveway. The disadvantage of this, however, is that anyone can open the doors, and, while this is all right in the country, it is not advisable in the city. The first drawing, therefore, shows an electrically operated mechanism, in which the doors are opened by turning a key switch on the post. The use of a key switch makes the garage just as secure, when closed, as it is with a lock on the door.

As shown in the detail drawing, the left-hand door is fitted at the top with a well-braced bracket of 1-in. angle iron, 3 ft.



Getting Out of the Car in Bad Weather to Open the Garage Doors Is Avoided by Means of the Simple Automatic Door Opener Described in This Article

long. To the outer end of this is pivoted another angle, running over to a flat-iron link on the right-hand door. This angle is 5 ft. 3 in. between holes for an 8-ft. opening. For larger openings, add 1 ft. to the length between holes for each foot additional opening. The link is made of two pieces of ¼ by 1-in. flat iron, 3 in. between holes, pivoted at the door end to an angle iron on the door. From the L-end of the 3-ft. bracket, 10-ft. of ¼-in. rope is run to a pulley on the right-hand door jamb, and fitted with a counterweight sufficient to open the doors when released. The doors are held closed by means of an ordinary spring garage-door bolt, fastened to the top member of the frame and socketed on the right-hand door. When this catch is released, both doors swing out. A stake is driven in the ground at the open position of the right-hand door, and a spring catch is fitted to the bottom of this door, latching on the post. This door arrives at the open position first and the catch holds it, while the other door completes its travel. To close, the right-hand door is released and swung in. This closes both doors, the left-hand one shutting first.



For the electrical mechanism, a wooden bar, 1 by 1½ in. by 4 ft. 9 in. long, is pivoted to the top of the frame as shown, the pivot being 12 in. to the left of the bolt. The end of the bolt is connected to the bar by a piece of cable. An old Ford starting motor is mounted above the bar, on the wall, about 9 in. from the outer end of the bar, and a piece of cable is run from the bar, wrapped around the end of the motor shaft, and fastened, so that, when the motor runs, the cable winds around the shaft, lifting the bar and with it the bolt. A spring returns the bar, and with it the starter armature, to position. The battery can be mounted in any convenient position, and the motor may be wired either through the door bolt, thus

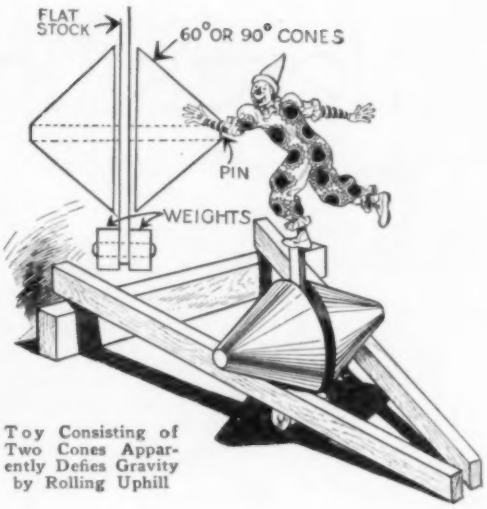
automatically breaking the circuit as soon as the bolt is withdrawn, or else wired direct to the switch; battery, motor and switch all being in series. In the latter case, the key switch must be turned off as soon as the door opens, but it is the preferable system, since a poor contact might be made at times through the door bolt, causing arcking and burning. A city-current motor might be used, provided the starting load would not be sufficient to blow the fuses, and this might be offset by gearing the motor. The switch on the post should be of a standard type for outdoor use, and should be housed in a weatherproof box.

Where there is no necessity for locking the operating mechanism, it consists simply of a rope run from the end of the bolt, through a hole in the garage and out to the post, where it is run over a pulley and down to a convenient height for the driver of the car to reach.

Clothesline Holders for the Basement

Attached to the joists of the basement so that they can be swung out of the way when not needed, the clothesline hangers illustrated have been found highly convenient. They consist merely of 1-in. boards of suitable length fastened to the joists with one nail. A notch is sawed near the lower end of each holder to take the line. Knots tied in the rope near the end holders keep the line taut.—William B. Toon, Philadelphia, Pa.

Clothesline Holders in the Basement Can Be Swung Out of the Way When Not in Use



Toy Consisting of Two Cones Apparently Defies Gravity by Rolling Uphill

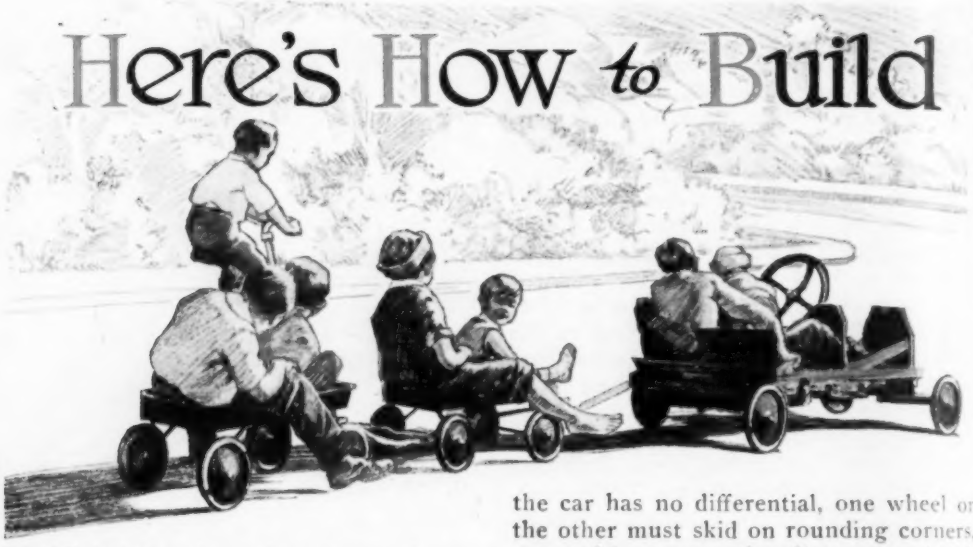
Toy Man Rolls Uphill

Apparently defying the laws of gravity, this amusing toy man seems to roll uphill. The toy consists of two cones, made of metal or wood and mounted on a suitable pin with their bases toward each other, but separated by a gap. A piece of flat stock is drilled and placed between the cones on the pin, this being a free-running fit. The upper end of the flat stock carries a figure of a man, cut out of thin metal, wood or cardboard, while the lower end is weighted down to hold the figure upright. Two straight sticks are placed on a table with the ends diverging, the spread ends being set on a block as indicated. As the double cone is placed on the lower end of the track, it will immediately roll to the higher end. The speed of travel is governed by the angle of the cones, a 90° cone moving faster than one of 60°. A 90° cone, 3 in. in diameter, will climb a track elevated about ¾ in. on a 15-in. track. Although the cones seem to travel uphill, close observation shows that they are really rolling downhill.

Salt Shaker for the Camper

The usual salt and pepper shakers cannot be carried conveniently in a camping outfit. It is, therefore, much better to use the small containers in which pepper and other spices are sold, as they can be closed tightly.—Harold E. Benson, Denver, Colo.

Here's How to Build



THE MAN or boy who attempts to use an old motorcycle engine in building a cycle car is always confronted with the problem of final drive. Placing the engine under the hood to imitate the big automobiles involves complications and expense, and results are not always satisfactory. In the first place, there must be a very long chain, or series of chains, running from engine to back axle, and, secondly, a solid axle, with a sprocket between the wheels and split bearings, must be used. This last has many disadvantages. For one thing, the body must be high to clear the drive chain, and, since the car has no differential, one wheel or the other must skid on rounding corners, even with an exceptionally narrow tread.

All of these difficulties are eliminated by building a single-wheel side drive, as illustrated herein. Its principal objection is that it doesn't look like the standard automobiles, but that, experience has proved, is a minor point, and it does away with nearly all the machine work demanded by other types.

Another thing; having the motor at the side makes it accessible to the driver even while under way and keeps it much cooler than under a hood, even with screen panels. As most of the motors used for this purpose have seen a lot of service, they demand a good deal of adjusting, and accessibility at all times is an important feature.

All the "machine" work required for the little car shown here was done with a hacksaw and drill, with the exception of welding and bolting a heavy-duty bicycle sprocket to one rear wheel. Incidentally, these wheels

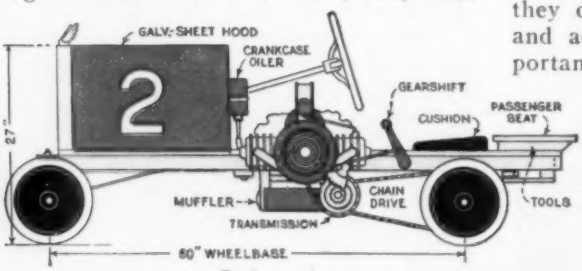


FIG. 1

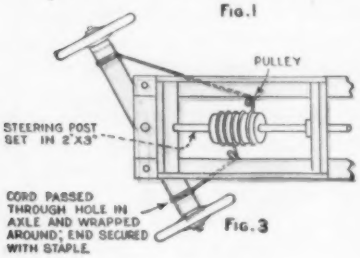


FIG. 3

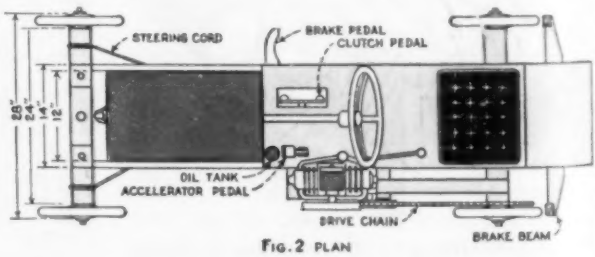
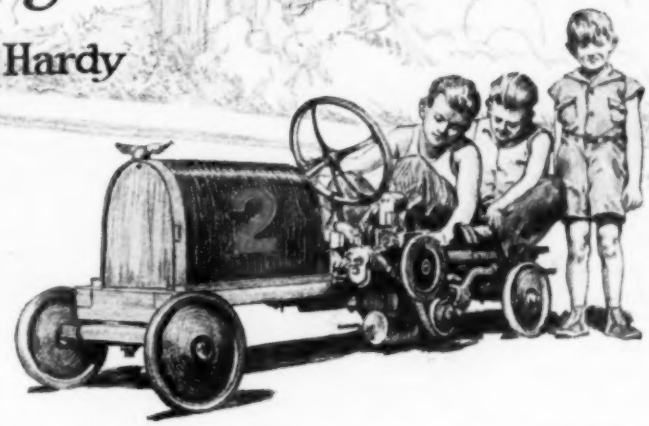


FIG. 2 PLAN

That Cycle Car

by Bob Hardy



already had been in use for over a year on a cycle car driven by a motor-wheel.

Note that the motor and transmission are supported on two parallel sections of 7/8-in. iron pipe. This particular motor is a very early model (Indian), and as several thousand were produced, it is probable others can be obtained for a very reasonable figure. The original, together with transmission, chain, etc., was purchased by the writer for $5. It was in excellent running order. Other types of motors require different mountings, of course, but a similar mounting can easily be adapted to them. A suggestion is given in the final drawings.

Having your motor—and in this connection select one of the lighter types, for there is plenty of power in a small one—begin with the main frame or chassis, making allowance for the style of motor mounting required. General outlines of the chassis arrangement are given in Figs. 1 and 2.

Substantial framing should be used, the original having been built of 2 by 3-in. stuff throughout. Net sizes for these in finished, or surfaced, Oregon pine, are 1 5/8 by 2 1/2 in. The main frame is 14 in. wide and 6 ft. long. The 5-ft. wheelbase permits turning on a short radius, provided the tread is at least 26 in. Bolt the frame members and motor supports together with 5/16-in. carriage bolts, the nuts being on the bottom, except on the front crossmember, where they should be on top so that the front axle can turn.

Steel axles are set in grooves in the wood axles, and held in place with iron tie-plates screwed down over them, as shown in Figs. 4 and 5. The front axle is offset, to allow room for the king bolt.

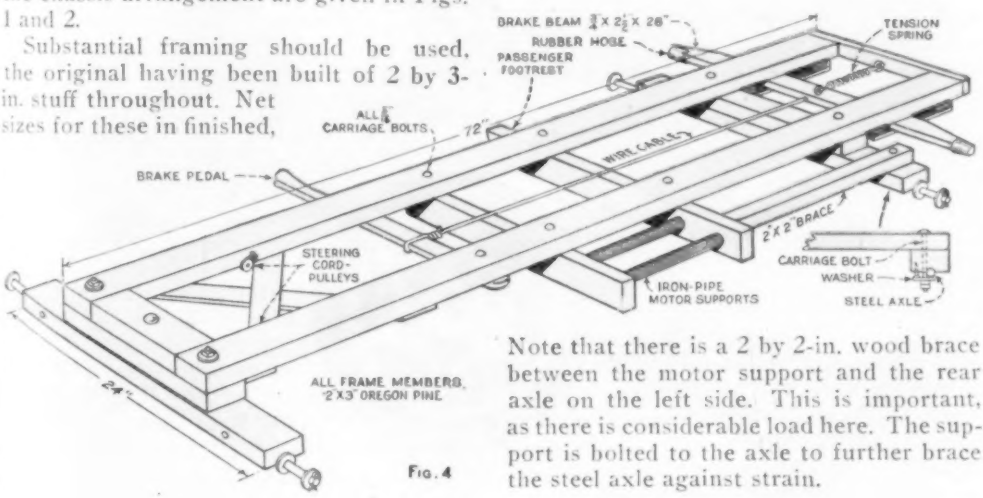


FIG. 4

Note that there is a 2 by 2-in. wood brace between the motor support and the rear axle on the left side. This is important, as there is considerable load here. The support is bolted to the axle to further brace the steel axle against strain.

In the matter of wheels and axles, if you have any choice, select the largest and strongest coaster wheels available, disk-type preferred. In our car, we used 11-in. wheels with a ½-in. steel axle and roller bearings. This has proved strong enough under load, but larger axles would be better. A 14-in. wheel with a ⅝-in. axle would be ideal for this purpose.

The steering gear, Fig. 3, is of the simplest type. A secondhand wheel and shaft can be purchased from an auto-wrecking yard for a small sum. Cut the shaft to about 36 in. in length and make a wooden drum for the steering cord. If no lathe is available, carve the drum from a block of white pine. It should be 3 in. in diameter, 6 in. long, and as true as possible with the shaft. Secure it with a long pin in a hole drilled through the shaft.

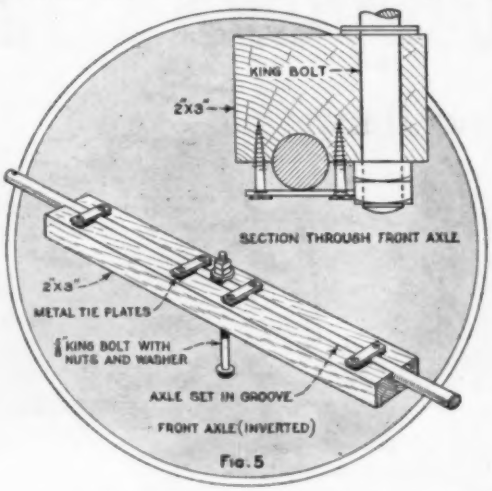
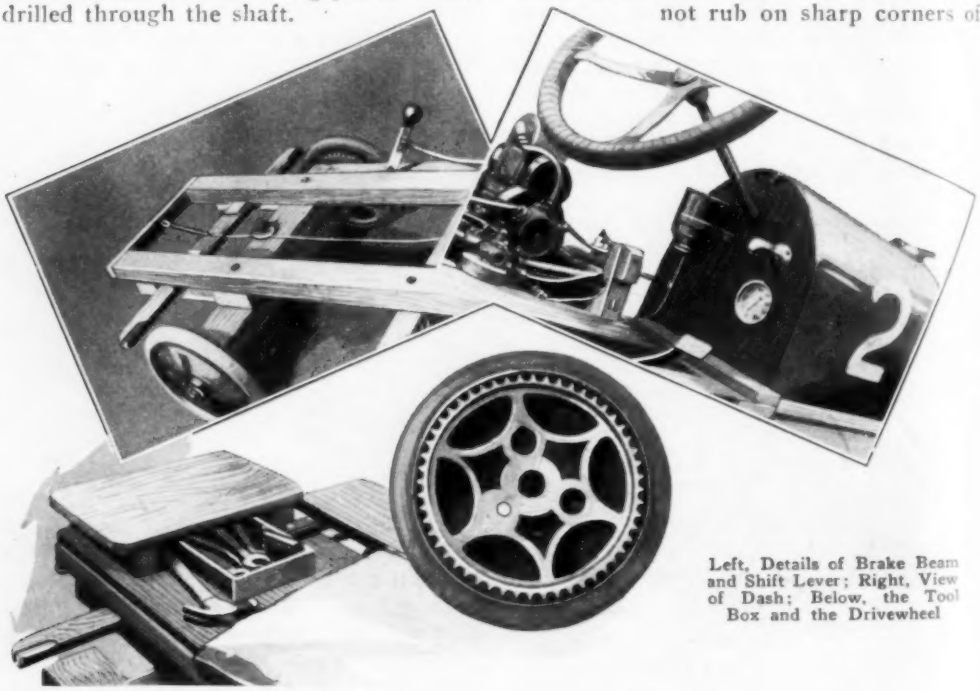


Fig. 5

Build up the dashboard and dummy radiator (Fig. 6) from ¾-in. material and brace them as shown. The assembly is bolted to the car frame as shown in the drawing. The front end of the steering post is set in a hole bored in the forward cross-member of the hood assembly. A cotter pin through the shaft, and a washer, prevent it from pulling out the dash.

In locating the pulleys to carry the steering cord, place one ahead of the other so that the cord will not climb on the drum. There should be at least five turns of the cord on the drum, secured by a staple on the middle turn. Note that the cords are crossed below the drum to cause the car to turn in the right direction. A good grade of sash cord should be used, as ordinary rope stretches too much under load. See that the cord does not rub on sharp corners of



Left, Details of Brake Beam and Shift Lever; Right, View of Dash; Below, the Tool Box and the Drivewheel

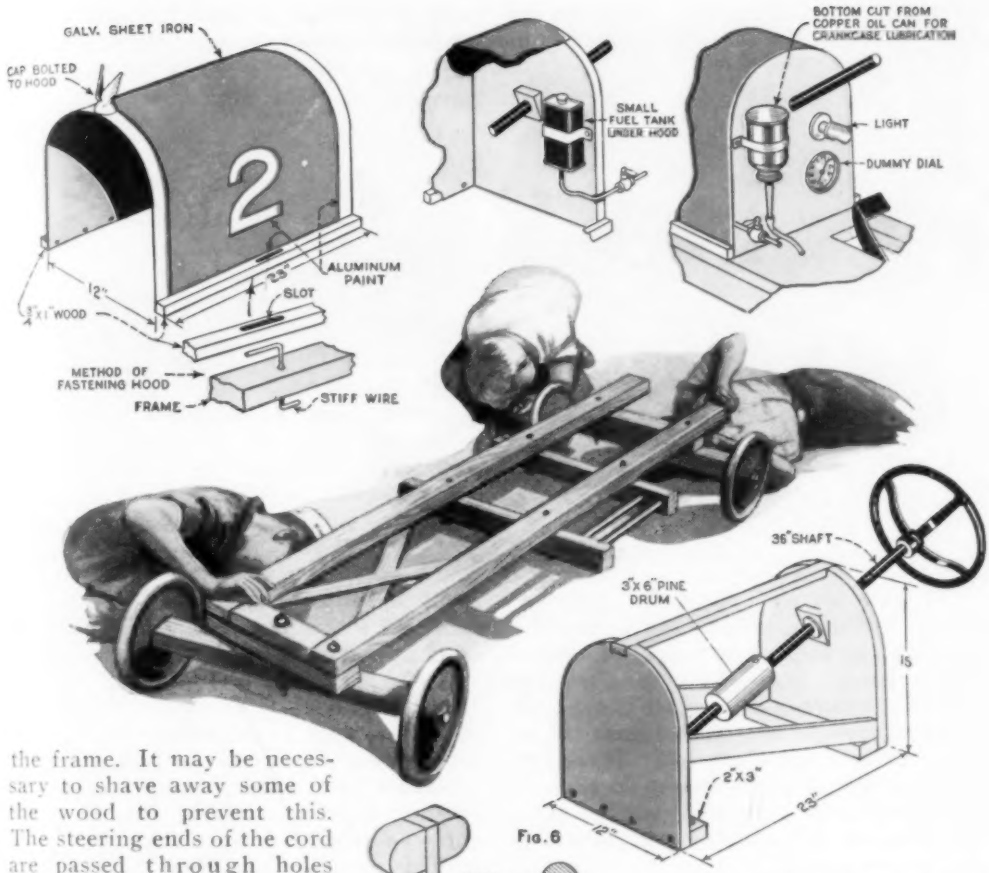


Fig. 6

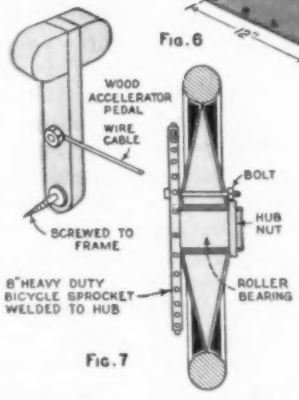


Fig. 7

the frame. It may be necessary to shave away some of the wood to prevent this. The steering ends of the cord are passed through holes bored in the axle, wound around two or three times and fastened with staples.

Having installed axles and wheels, locate the motor, and make some provision for tightening the drive chain. In our car, this is done simply by moving the transmission and motor forward on the parallel bars, but other engines may require a different arrangement. It may be necessary to chip away places in the wood frame member to allow for protruding nuts, carburetor, etc., but do not cut out enough material to weaken the frame. It is better to raise the motor or set it out farther.

Next build the brake assembly, Fig. 4. This is a very simple but efficient type and has been used by the writer on a long series of small cars and coasters. It consists of a single brake beam operated by a foot lever through a wire cable. A tension spring holds the beam away from the wheels when not in use, and pieces of rubber hose are nailed to the ends for brake shoes.

Make the hood of a sheet of galvanized iron with wood strips nailed along the bottom edge. A radiator cap is bolted to the metal hood. Slots should be cut in the wood strips so that a wire hook in the side frame can be slipped up and given a quarter turn to hold the hood in place.

Controls must be adapted to the particular model of engine used. In our case, the original levers and pedals were used, with the exception of the accelerator. For the latter a pedal was made, as shown in Fig. 7, to connect with the

carburetor through a wire cable, the tension spring on the carburetor keeping the throttle closed until the pedal is pressed down. The original gear-shift lever was cut down to about 8 in. long, and adapted to the car through the original tie-rod, which was sawed off to suit. The double-acting clutch pedal was also installed, almost without any alteration. These controls are placed conveniently so that the pilot has at least one hand free at all times for steering. The kick starter is left on the transmission intact.

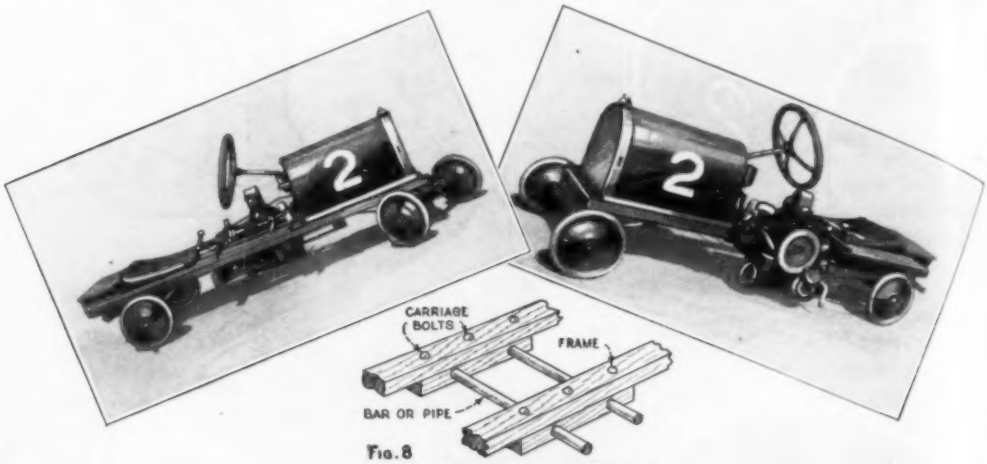


Fig. 8
SUGGESTION FOR MOUNTING OTHER TYPES OF ENGINES REQUIRING TRANSVERSE SUPPORT

Thus the mechanism is complete, with gas accelerator, gear-shift lever, clutch and brake as on a big car. Footboards are built around these controls, requiring considerable fitting but making a very neat job. Screws are used so that the entire floor can be removed quickly for inspection of any chassis parts. The driver sits on a cushion laid directly on the floor; the passenger has a raised seat, about 4 in. higher, behind the driver. One of the passenger's feet rests on a sort of shelf or guard built over the chain, the other on an extension of a motor-support frame member Tools are carried in a box under the passenger's seat.

A salad-oil can, with screw cap, is used on our cycle car for gasoline fuel. It holds only about ½ pt., but this is enough for four or five miles at a filling and that is as far as parents care to have their young pilot travel at a time.

Another advantage of the small fuel supply is that it reduces the fire hazard, which, however, is very slight, since the tank is isolated under the hood, and the shut-off valve instantly accessible without lifting the hood. For the crankcase oiler, a bright new copper oilcan from the ten-cent store is used. The bottom is cut out with a can opener, and it is then suspended on the dash with the spout soldered into a small copper feed pipe. A shut-off valve regulates the oil supply in proportion to the speed of the engine.

This design of cycle car has proved remarkably compact, solid and free from vibration. With its low gear-ratio it pulls up surprising grades without slacking speed; in fact, it has frequently towed two coaster wagons, each with two passengers, besides driver and one passenger on the car.

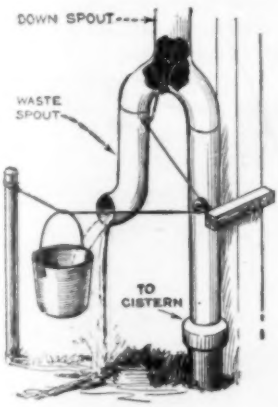
The total expense, excepting labor, but including motor, transmission and all fittings was approximately $15. This includes secondhand wheels valued at $1 each. Paint is also included in this figure. A striking job was made with an Indian-yellow chassis, light-green hood with aluminum-paint trimmings, and walnut stain on the floorboards. The wheels were left in their original orange.

With any small air-cooled motor between 1 and 4 hp., this little car can easily be duplicated. You may be assured it will not run into any great expense, nor will you encounter any serious constructional problems. Speed depends largely

upon the size of the drivewheel, but as the original is geared, fifteen miles an hour provides plenty of thrills and at the same time is a safe rate on outlying streets.

Keeping Dirty Rain Water Out of the Cistern

In order to keep the first wash of rain water, which is usually quite dirty, owing to the accumulation of dust in the gutters, out of the cistern, the arrangement illustrated has been found highly satisfactory. It consists merely of an inverted Y-fitting equipped with a valve to divert the water in either direction. A length of heavy cord is tied to the handle of the valve, then run through a pulley and over to a stake driven into the ground so that a pail, slipped over the cord, can be hung directly under the open end of the fitting as indicated, the other end being connected to the pipe which runs to the cistern. The valve is pulled over so that the first wash will be diverted into the pail, which, when filled, pulls the valve over in the other direction automatically, and the clean water is run to the cistern.—R. L. Starzl, LeMars, Iowa.



Oars for Ship Models

The making of wooden oars for ship models being a slow and tedious task, I decided to try bamboo and found that the oars could be made in one-fourth of the time previously required. In addition to being easier to make, bamboo oars are also stronger than those made of wood.—Theo. Michnik, Chicago, Ill.

A large safety pin makes a convenient holder for metal street-car tokens; a dozen of them will go on the pin and they can easily be removed as needed.

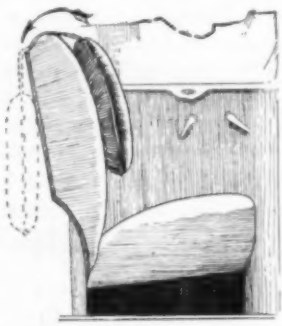
Paper Bag Tied over Mouth of Food Grinder Catches the Crumbs

Bag on Food Grinder Catches Crumbs

When grinding bread, crackers and similar kinds of food, which make crumbs, it is a good idea to tie an ordinary paper bag over the mouth of the food grinder as shown. The crumbs will be caught in the bag, which prevents getting the table messy. I always use this method and find it a great convenience.—Mrs. J. C. Reinhard, Manhattan Beach, Calif.

Cushion for Driver Insures Comfort

When two persons drive the same car, one may desire to use a cushion but the other not, which is sometimes rather inconvenient for the former as he usually finds the cushion somewhere on the back seat. A good method of keeping the cushion at hand is shown in the drawing. It is fastened to a short cloth strap, one end of which is tacked to the seat. When the cushion is not wanted, it is merely thrown behind the seat.

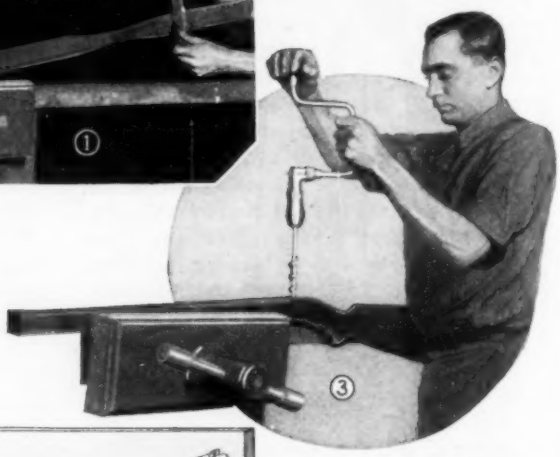


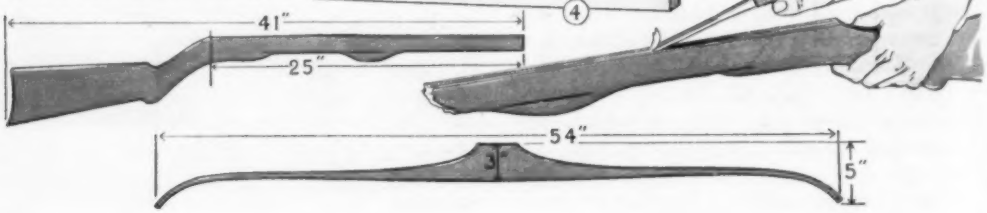
SPORT with a

FEW outdoor sports can equal archery for pure fun and skill. The twang of the string and "plank" of the arrow reaching its mark, whether that mark be a target or light game, have a brand of music all their own. But take your bow and arrows into the workshop, add a gunstock, automatic trigger and arrow guide, and you have a weapon that will open the eyes of other sportsmen. It can be held in any position while shooting, speeds the arrow on its way at the touch of the trigger and, with a little practice, can be made to hit the bull's-eye every time.

The bow itself is made of osage orange. Secure a piece, cut down to 54 in. long, and then shave it until it is 2 in. wide, 3 in. thick at the center and 1⅛ in. thick. Then place it in a vise and trim down carefully as in the drawings and Fig. 1.

Build a wood-steaming box, Fig. 2, long enough to take the straight bow, with a 1-in. hole in one end to let in steam from a kettle. After steaming for several hours, the bow is limp and may be allowed to dry on a board





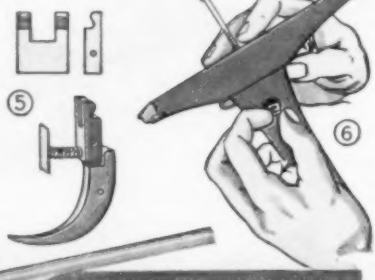
CROSSBOW

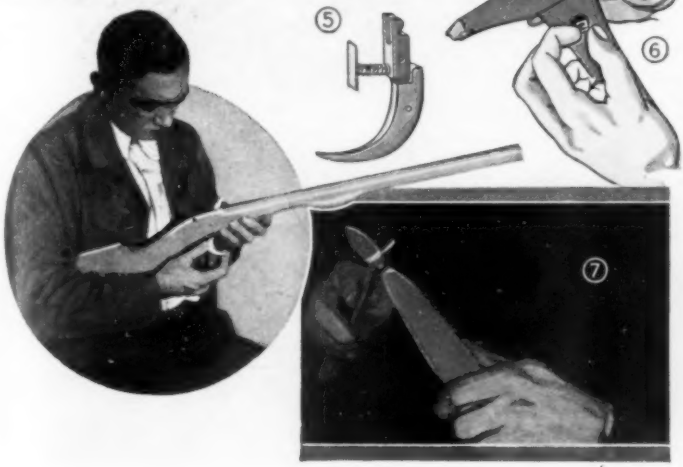
by Kenneth Murray

fitted with forming pegs, Fig. 4, made of pieces of broom handle. This will make it take on the reflex shape according to the curve shown in the drawing.

The stock, of any good hardwood, is next cut out on a bandsaw. Black walnut was used for the stock illustrated, but birch, maple or oak are equally satisfactory. The stock is 41 in. long; 25 in. from the end drill a hole as in Fig. 3, which is then squared out for the trigger mechanism. An arrow guide, trough-shaped, is cut out from this hole to the end of the stock by means of a gouge, as indicated at the right, Fig. 4.

The trigger mechanism consists of three parts, the trigger, spring and string catch, and may be filed from brass to the shape shown in Fig. 5, or wood patterns may be cut with a knife from soft wood and taken to a brass foundry. The parts





are pivoted in place in the hole in the stock with steel crosspins driven through the wood.

In the underside of the stock, 1 in. from the "muzzle" end, drill a ½-in. hole, three-quarters of the way through, and into this drill a bolt hole from the muzzle end of the stock. The bow can then be fastened to the stock with a ¼ by 2½-in. stovebolt and washer, the nut being introduced as in Fig. 6.

The "nocks," Fig. 7, which are slots in the bow ends to engage the string, may be carved directly in the wood, if desired. A more finished appearance is given by attaching bone nocks. These are filed

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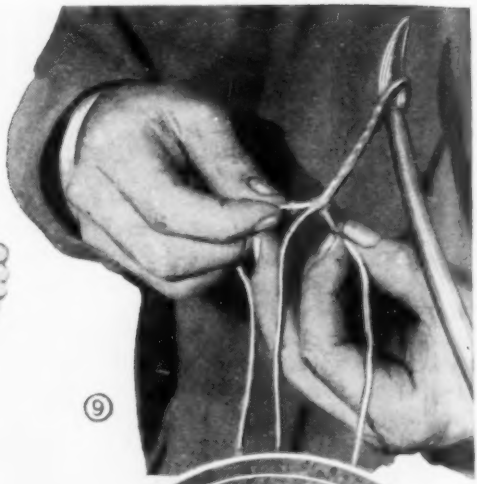

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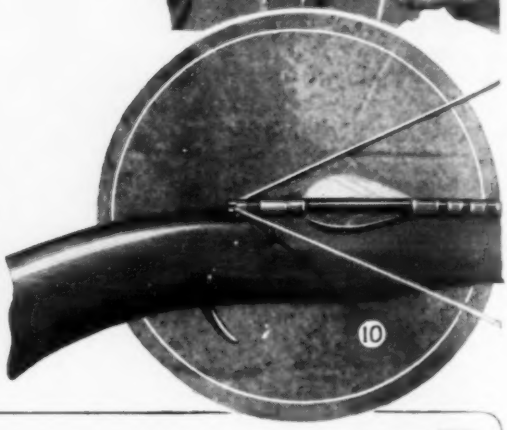

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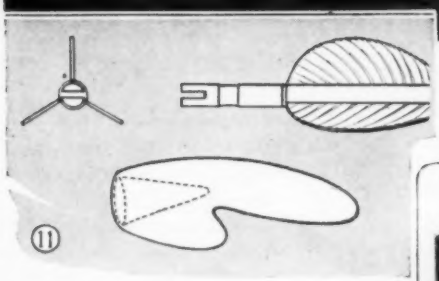

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down from pieces of cowhorn to the shape shown in Fig. 11. They may be polished with pumice and fitted tightly to the bow ends by friction. Waxed Irish-linen cord is used for the string, braided from three strands, as in Fig. 9.

The arrows are 28 in. long and made of birch doweling. The points are trimmed down to take an empty cartridge shell, Fig. 14, which is dented in the side with a punch to make it hold securely. Turkey feathers are split with a razor blade and trimmed for feathering, which may be done with a clamp like the one illustrated in Fig. 12, or with a home-made wood vise. Use a good waterproof glue, and the feathers will hold securely. They may be dyed any color desired before attaching.

A convenient quiver or carrying case (Fig. 8) can be made from a piece of cowhide, 22 in. long by 9 in. wide, joined with thongs of the same material on the side and having as a bottom a round wood disk tacked in place.

Figure 10 shows the arrow in position on the bow ready for a pull of the trigger. To hold the arrows securely on the stock while shooting, flatten the ends of two short pieces of brass rod, bend them over and insert in the end of the stock, as shown in Fig. 13. They should barely touch the arrow and are positioned so as to allow the feathers to pass freely.

After stringing up the bow, Fig. 16, you are ready to try it for strength. With infinite caution gradually bring the string up to the trigger catch, as in Fig. 15. On the pull necessary depends the strength of the gun, and the bending of the bow must be done gradually in order to "break it in" without splintering. If found too stiff, it should be shaved down gradually, trying it each time. When at last the bow is of the right strength (and it should give stiff resistance), an arrow may be inserted for a trial. Such is the speed of the bow gun that the pulling of the trigger and arrow striking the target, appear simultaneous. Never pull the trigger without an arrow in the gun, as the string will snap in two.

The bow gun may now be finished by staining the stock and varnishing both stock and bow. A suitable target is made from hay or straw board with cords and covered with white oilcloth on which the bull's-eye is painted.

In shooting the bow gun, it is not difficult to secure perfect aim every time, and with considerable practice one learns to allow for "windage," that is, the strength of the wind throwing the arrow off its course. This is much less than with the ordinary bow and arrow, however, as the bow gun is tremendously powerful, and, due to its speed, the arrow is less affected by wind and gravity than otherwise.

The usual precautions should be observed while on "shoots." The gun is perfectly harmless without an arrow in it, so the arrow should never be inserted until each shot. Practically any kind of small or large game may be hunted and, because of the accuracy with which the gun sends the arrow on its way, misses will be found few and far between.

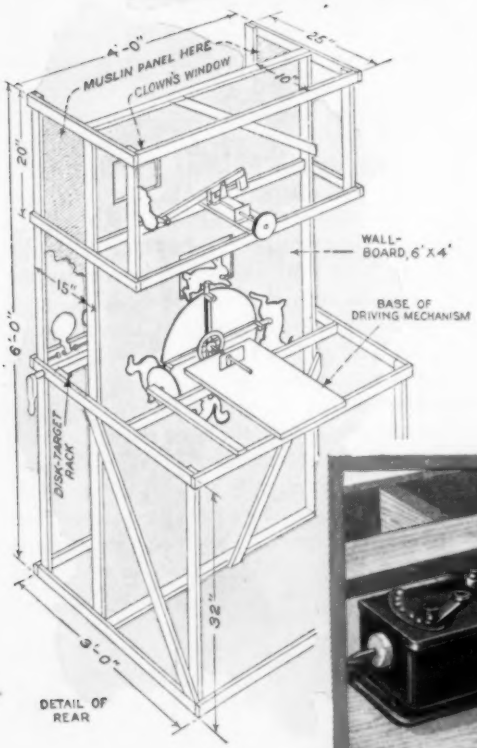
¶A short chalk line, held taut with both hands over a glass or metal surface in which it is impossible to drive a nail or tack, can be snapped easily by the teeth, if a short length of string is attached to the center of the line.

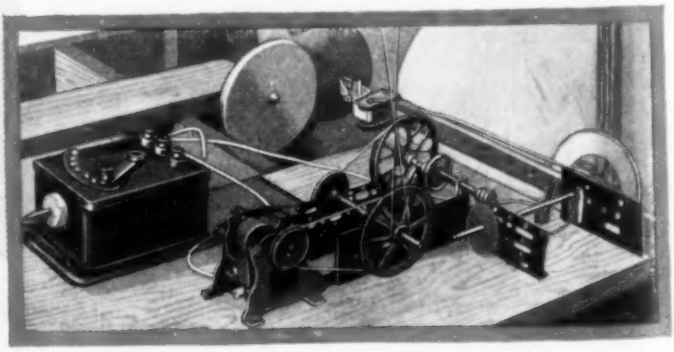
MOVING TARGET MAKES

By
HI SIBLEY

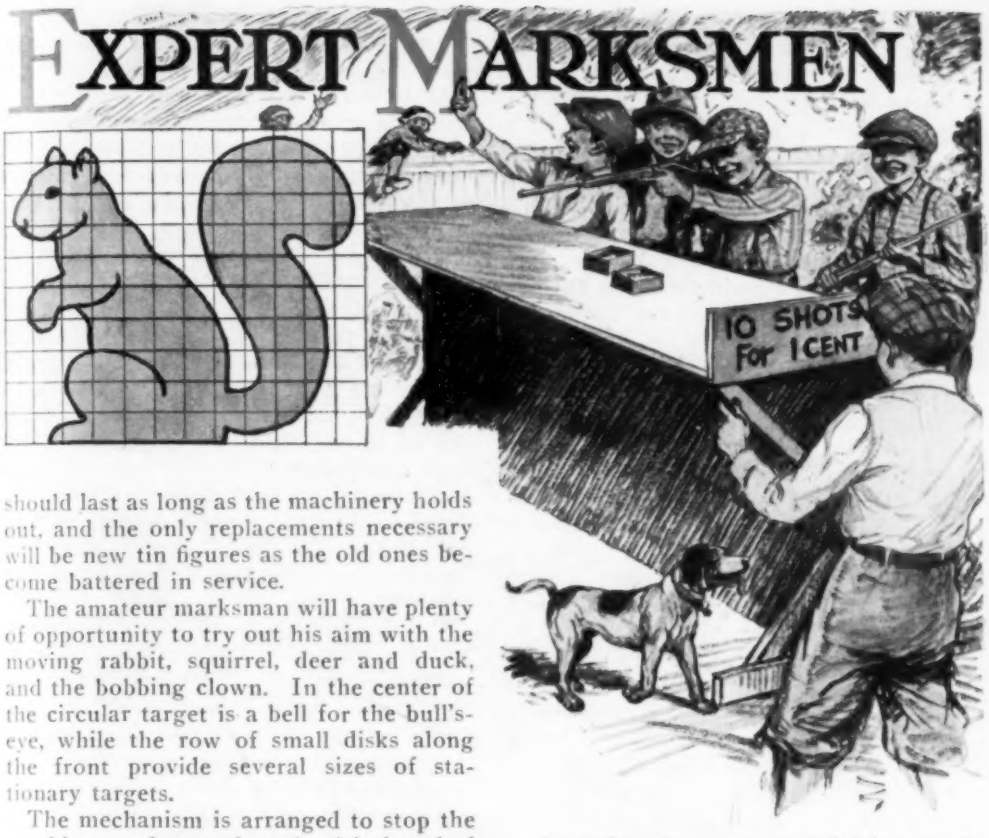
IT HAS been a long time since we had anything in our neighborhood that created so much excitement as this mechanical shooting gallery. Boys with air rifles came by the dozen, and delivery service was temporarily suspended, as milkmen, icemen and butchers' boys tarried to test their marksmanship. Even little tads of five and six became so expert with practice that nearly every shot knocked over a moving target, and we had to limit the shots per customer so that all could have a turn.

Construction is comparatively simple if you have a small motor and a few pulleys and shafts from a standard toy-constructor set. The motor used in the original cost only $1.25 and had already seen considerable service in other toys. Built according to these plans, a duplicate





EXPERT MARKSMEN



should last as long as the machinery holds out, and the only replacements necessary will be new tin figures as the old ones become battered in service.

The amateur marksman will have plenty of opportunity to try out his aim with the moving rabbit, squirrel, deer and duck, and the bobbing clown. In the center of the circular target is a bell for the bull's-eye, while the row of small disks along the front provide several sizes of stationary targets.

The mechanism is arranged to stop the machinery when a tin animal is knocked over, and an electric bell rings when the clown is dropped. A hand lever is provided at the side to set up the small stationary disk targets. Tough woodboard is used for the front wall and backstops behind the apertures, amply protecting the tender, as BB-shot cannot penetrate it.

Make the entire framework, as shown in the perspective, of about ¾ by 3-in. stuff, or any similar material you have on hand. A single sheet of woodboard, which comes in standard sizes of 4 by 6 ft., is used for the front face or wall. This runs from 4½ to 7 cents per sq. ft. Do not cut the windows or apertures for the animals and clown, until they have been properly located after the mechanism is set up. However, by following the dimensions given, they will come about as shown in the front-elevation drawing. They are cut by boring four holes at the corners and cutting through with a keyhole saw. Cardboard frames are glued to the woodboard and can be replaced when necessary.

Assemble the motor and driving mechanism on a flat board, which later is located properly on the framework and screwed to it. Although any small motor will do, the photos illustrate the type used in the original. This receives its power from a lighting circuit through a transformer, or from a storage battery or dry cells. Do not use over 4 to 6 volts, if an electric bell is to be incorporated.

Note the motor-speed reduction through two sets of pulleys and belts and a worm and wormgear. The animals should travel at from 20 to 25 r.p.m. at first. As the marksmanship of your customers improves, the targets can be speeded up. It is not necessary to follow the exact assembly shown if you can arrive at the required speed reduction by any other arrangement.

You will note that the four tin animals are supported on the arms of a wood spider, 24 in. in diameter, which is reinforced by a cardboard disk. This spider is built up on two pieces about 1-in.-sq. section and halved together at the hub so

the surfaces will be flush. A tin contact ring or commutator, concentric with the hub, about 4 in. in diameter and ¾ in. wide, is nailed to the spider, with a springy tin strip, or brush, in permanent contact with it. When an animal is knocked over, a contact is made which shorts the transformer, stopping the motor until the gallery tender sets the animal up again. The tin ring is easily cut from a sheet by first cutting the outside perimeter, then cutting through diagonally to remove the inside portion.

The drawings illustrate the details of the animal supports and the manner in which they drop down and form the electrical contact. Insulated wires, from animal support to hub, are secured to the spider arms in the manner illustrated. The bobbing clown is supported by a similar device, so that, when he is knocked over, an electrical contact is also formed which, however, rings the electric bell instead of stopping the motor.

Make the rocker arm for the clown of cedar, white pine or other light wood, and after clown and wiring are installed, counterbalance it evenly by means of a wood block or weight at the other end, so that it will operate with the minimum of power. It is actuated by a crank arm to which is attached a link, as shown. A large-diameter pulley at the outer end of the crankshaft is driven by a small pulley and belt. Arranged according to the diagram, this will be a quarter-turn drive, but it runs very nicely. The wires on the rocker arm should lead off near the axis so as to impede action as little as possible. The location of the electric bell is shown in the photograph.

The small disk targets, ranged along a board in front, are each cut in one piece, hinged back of the board, as shown in the detail sketch. A single stout wire, fastened with staples to the blocks between the targets, serves as hinge pin for all, and the targets are returned to position simply by lifting the lever at the side.

Although the animal targets in the original of these drawings remained upright through the entire revolution, until shot down, as a precaution two cardboard disk wheels were installed at the right and left of the large spider to push the animals back into place in case they were knocked over by accident. A wood hub glued to the pasteboard prevents these disks from wabbling on their nail spindles.

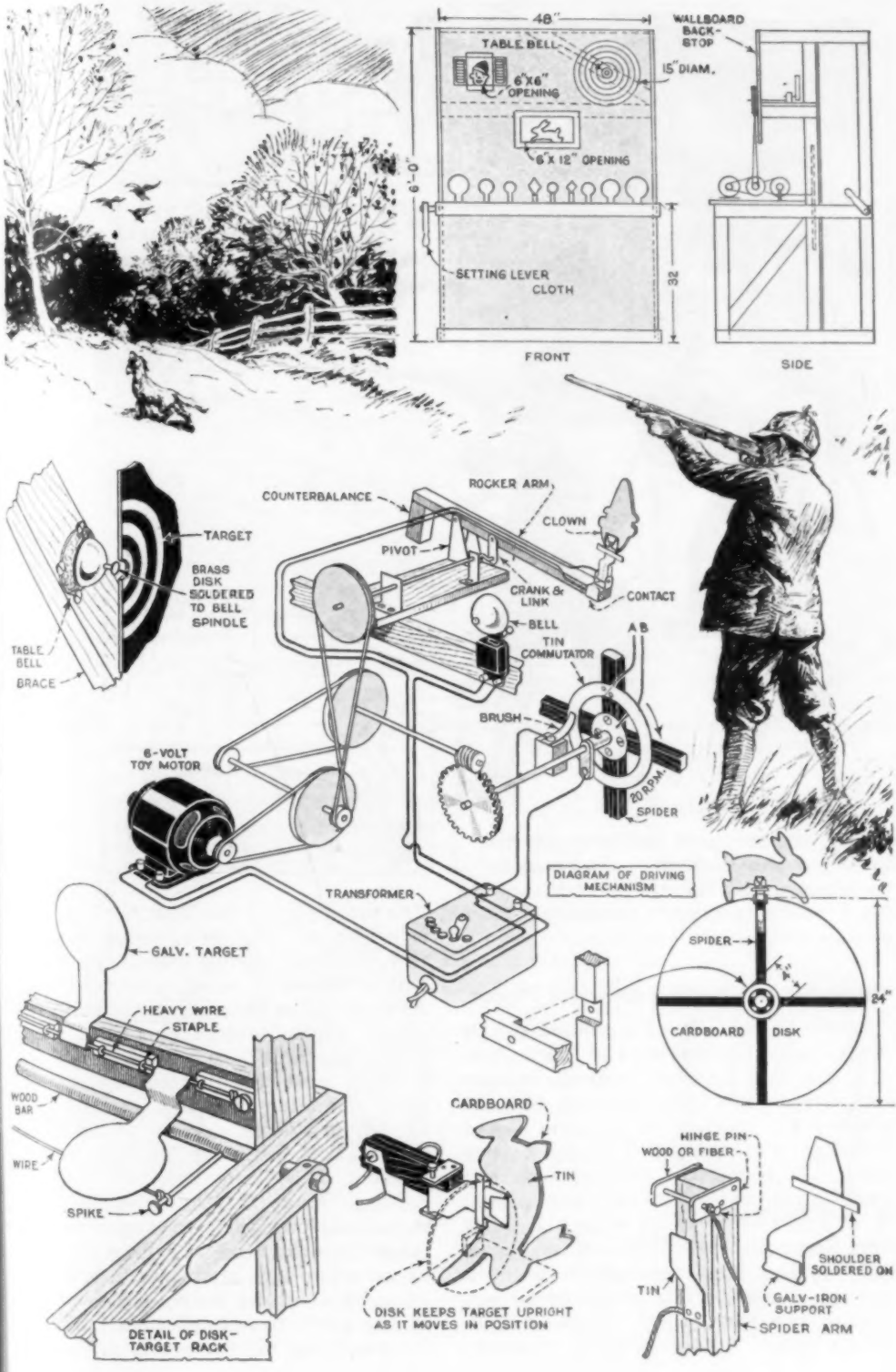
It is much easier to cut the animals from tin than one might think, provided a good pair of snips are available. First lay out the outlines on cardboard, marked into ½-in. squares as shown, and cut out with scissors. Fairly heavy white pasteboard should be used. These can then be used as patterns for marking the outlines in tin. Each animal and clown should have the pasteboard duplicate cemented to the front side, as this prevents the tin back from becoming unnecessarily battered. Ambroid is better than glue for the purpose. After the pasteboard facings are pretty well shot up, they can easily be replaced. A flat tin socket is soldered to the back of each animal, slipped over the support, and the end of the latter bent over. Thus the targets are easily removed.

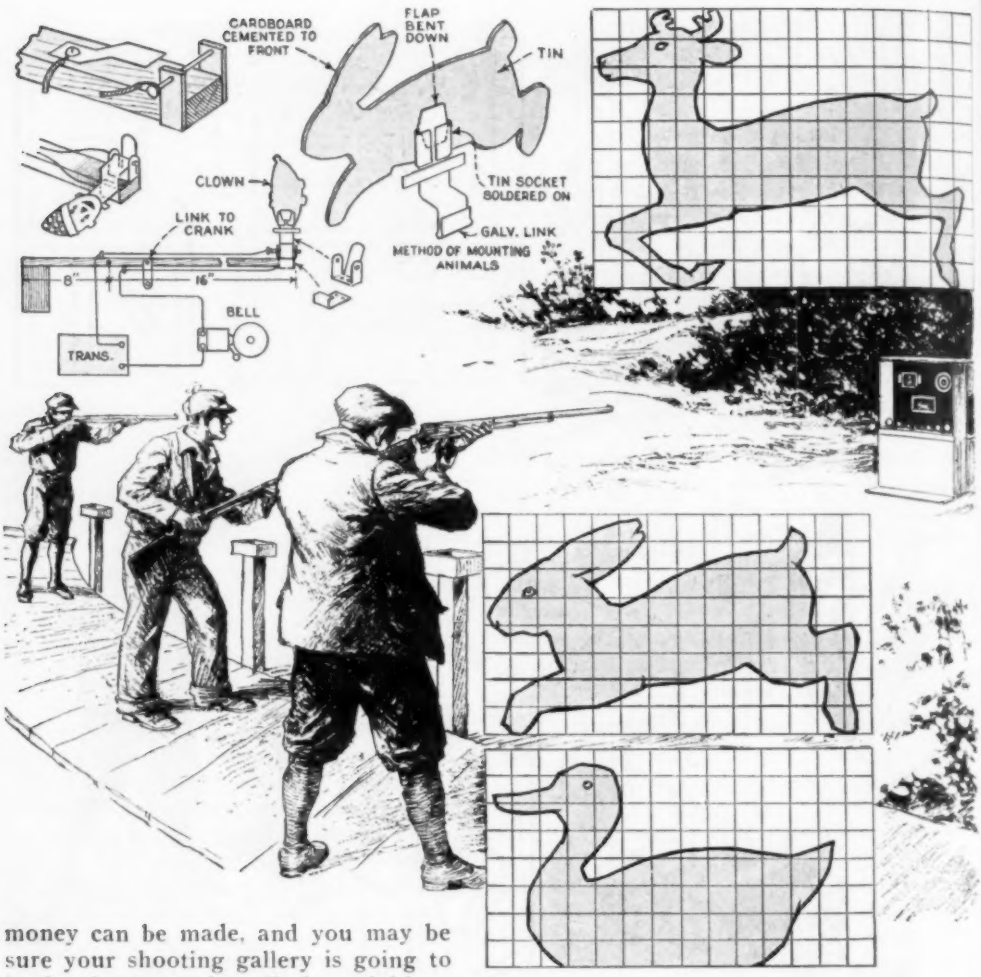
Oil all bearings, particularly the worm and wormgear, and see that all moving parts operate freely. In proper condition, the little motor recommended will run the entire mechanism without overloading. A good location for the gallery is just in front of the garage doors, where the garage lighting circuit is available. Also, the doors provide a good backstop for any wild shots that miss the target completely.

Of course only BB-shot and air rifles should be used, though the gallery could be adapted to .22-caliber rifles by making the front wall bullet-proof and cutting the figures from sheet steel—a job for special equipment. Better stick to the air rifles; they are safe, and quite as exciting as the others.

About 24 ft. from the front of the target, place a table or counter so that patrons will be obliged to stand back of it in firing. Such a counter also serves as a rest for the guns, cash box and ammunition. This distance makes it plenty sporting enough with air rifles and can be increased as marksmanship improves. When the writer first set up the gallery in his back yard, some of the patrons could scarcely hit even the gallery, but after an hour or so of practice the moving targets were dropping at almost every crack.

By charging a reasonable fee for a certain number of shots, quite a little pocket


48"
TABLE BELL
6"X6" OPENING
6"X 12" OPENING
15" DIAM.
WALLBOARD BACK-STOP
6'-0"
SETTING LEVER
CLOTH
32
FRONT
SIDE
TARGET
BRASS DISK SOLDERED TO BELL SPINDLE
TABLE BELL
BRACE
COUNTERBALANCE
ROCKER ARM
CLOWN
PIVOT
CRANK & LINK
CONTACT
BELL
TIN COMMUTATOR
A B
BRUSH
6-VOLT TOY MOTOR
20 R.P.M.
SPIDER
TRANSFORMER
DIAGRAM OF DRIVING MECHANISM
GALV. TARGET
HEAVY WIRE
STAPLE
WOOD BAR
WIRE
SPIKE
DETAIL OF DISK-TARGET RACK
CARDBOARD
TIN
DISK KEEPS TARGET UPRIGHT AS IT MOVES IN POSITION
SPIDER
24"
CARDBOARD DISK
HINGE PIN
WOOD OR FIBER
TIN
SHOULDER SOLDERED ON
GALV-IRON SUPPORT
SPIDER ARM



money can be made, and you may be sure your shooting gallery is going to be headquarters for all the neighborhood youngsters until something more exciting bobs up.

Remedies for Dusting Concrete Floors

Boiled linseed oil and a sodium-silicate (water glass) solution are two simple remedies that can be used, at small expense and without much trouble and time, to prevent the dusting of concrete floors. The linseed oil is applied in one or two coats. It penetrates the concrete and tends to bind the loose particles together. It also prevents water or other fluids from being absorbed. The sodium-silicate solution has been successfully used in many instances. The preparation consists of one part of 40° Baume sodium silicate mixed in 3 or 4 parts of water. The more porous the floor, the less water is necessary. Before applying this mixture, the floor must be thoroughly cleaned with a scrubbing brush and clean water. As soon as the floor is dry, the solution is evenly applied over the surface with a whitewash brush. When dry, the floor is again washed with clean water and a mop, and after this, another application of sodium silicate is given as before. A third coat is given the floor in the same manner. It is better, however, to prevent concrete floors from dusting by laying them correctly than to apply remedies later. A dusty concrete floor is caused by using too lean a mixture in making it, by using too little water in the mixture, by too much troweling of the surface or by permitting the surface to dry out too

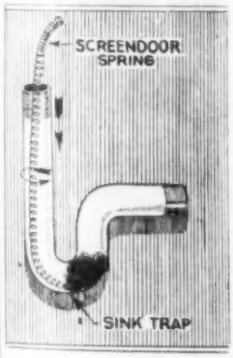
quickly. For the best kind of floor, use a mixture consisting of 1 part cement, 2 parts sand, 4 parts pebbles or broken stone and enough water to make a "quaky" mixture. After laying the floor, trowel the surface just enough to smooth it. If the water stands on top, do not use either sand or cement to dry it up, but allow it to evaporate. The floor should be allowed to dry for a week; no draft should be allowed to touch it, and the temperature should be kept as constant as possible.

Flux for Brazing

The usual proceeding in brazing is to apply borax to the metal dry, after the metal has been thoroughly scraped or cleaned. It has been found, in a large coppersmith's shop, that a better way is to coat the metal with a solution of boric acid. The advantage of this is that the solution penetrates every crevice and covers the surface completely, thereby protecting it from oxidation. The boric-acid solution is made by adding quantities of the acid to hot water, allowing it to remain for several hours, with an occasional shaking, and then bottling for future use.

Coil Spring Removes Obstruction in Sink Trap

Stoppages in a trap can readily be removed by stretching out an old screen-door spring until the coils are ½ in. apart when released. Turn the spring while you are pushing it into the pipe so that it will screw into the obstruction, which can then be pulled out with little trouble.—Mrs. Rebecca Briekey, Bedford, Ind.



Bookbinder's varnish can be made of gum shellac, 8 parts, gum benzoin, 3 parts, and gum mastic, 2 parts. These ingredients are pulverized and placed in denatured alcohol, 50 parts, and oil of lavender, ½ part.

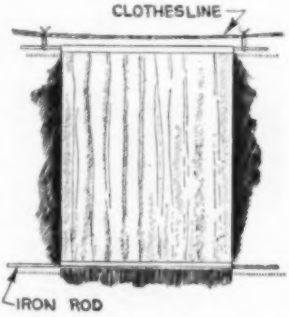
Neat Arrangement of Shelving for Utilizing Space under the Basement Stairway

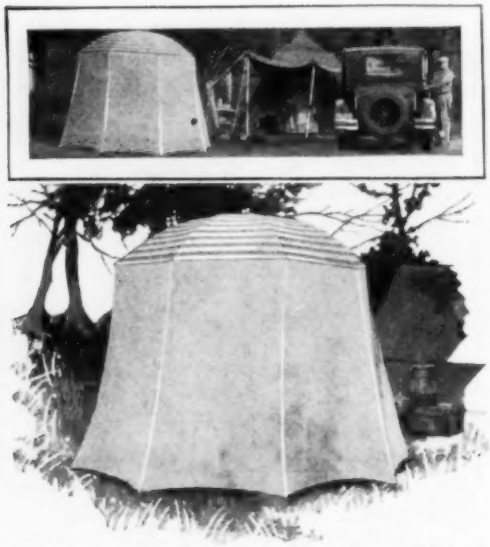
Use of Space under Stairway

In many homes the space under the basement stairs is wasted, but it can be utilized for shelving as shown in the photo. Cleats are fastened to the stair frame to hold the shelves. In cases where a workbench is located near the stairway, this arrangement has been found especially suitable for storing small boxes and cans containing nails, screws, etc.

Drying and Stretching Curtains

Many housewives dry their lace curtains on special frames so that the curtains will retain their shape when dry. A simpler method of accomplishing the same result is shown in the illustration. A ⅜-in. iron rod is placed in the top and bottom hem and the top rod is then fastened to the clothesline with loops of cord as indicated. Several days before using, the rods should be enameled or varnished in order to prevent them from rusting while in the curtain hems and causing stains, or a regular brass-plated curtain rod can be used.





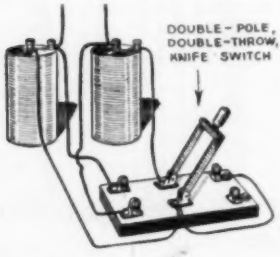
Fine-Mesh Netting Sewed to Edge of Large Umbrella Makes Fly and Mosquito-Proof Inclosure for Campers

Shelter Made from Large Umbrella

A large umbrella of the kind used by artists or at bathing beaches can be converted into a comfortable shelter by sewing fine-mesh netting to the edge as shown in the illustration. The lower edge of the netting is reinforced with cloth tape, and is provided with eyelets so that it can be fastened down securely. It is practically fly and mosquito-proof, and as a camp dining room it is hard to beat.—Mrs. R. K. Garnett, St. Joseph, Mich.

Quick Change from Series to Parallel

To change from a series to a parallel connection on dry cells, storage batteries, or other devices, some rewiring is usually necessary, but with the hookup shown in the drawing this change can be made very quickly by merely throwing over a double-pole, double-throw knife switch. Trace the wiring carefully so that there will be no mistake, and you will find that considerable time can be saved by this arrangement.—Herman Schepler, Sabula, Iowa.



Extended Starter Button

The starter button on the Ford model-A car is in a difficult place to reach. An extension placed on it will bring it high enough to permit pressing it without twisting the ankle, the heel of the shoe resting on the brake pedal while the toe is placed on the starter button. The extension should be made of iron rod, the same size as the original and about 4 in. longer. One end is threaded to fit into the top of the starter switch, and the other is fitted with a suitable button. An accelerator button is good, if one can be obtained; if not, the knob can be sawed off the original rod and welded to the new rod. The older cars of this model had a switch which required heavy pressure to close. This type had a cotter pin through the lower end of the rod, and an extension should not be placed on such a switch, as the pressure needed will bend the rod in time.—E. T. Gunderson, Jr., Humboldt, Ia.

Tar-Paper Shields Foil Cabbage Maggots

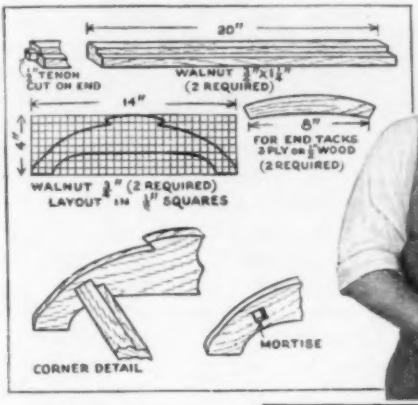
Maggots, which usually prevent cabbage plants from thriving, can effectively be prevented from getting at the plants by the simple method shown in the illustration. When the plants are still seedlings, a square piece of tar paper, about 3 or 4 in. in dimensions, is placed around the stem of each as indicated. A diagonal slit is cut halfway across the paper and a hole is punched in the center. Clubroot, the destructive cabbage disease, can best be prevented by applying limestone to the soil.—C. M. Wilcox, Torrington, Conn.

¶A small magnifying glass can be made by inserting a strong spectacle lens into the narrow end of a telephone mouthpiece. The glass is ground on an emery wheel so that it fits exactly, and thick shellac is used to hold it in place.

Upholstered Footstool Simple to Make

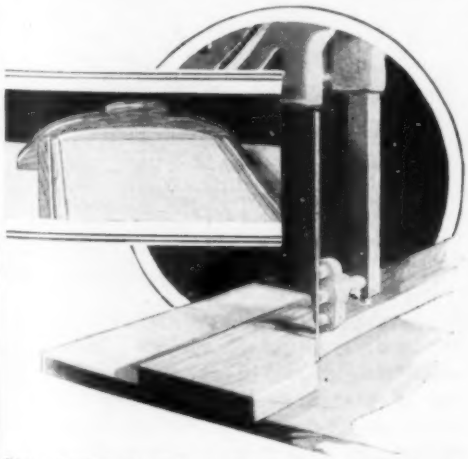
By HAROLD BROWN

ADAPTED to be made from scraps of material that otherwise would go to feed the furnace, the footstool shown in the accompanying drawings is nevertheless a very useful and attractive piece of furniture. Since it is made from the small pieces that accumulate in every home shop, the cost, aside from the trifling expense of the tapestry covering, is practically nothing, and the piece can be knocked together in an hour or two.



Lower Left, Footstool, Upholstered in Tapestry; Right, Finishing a Curved Surface with the Spokeshave

Two 4 by 14-in. pieces are required for the ends. While the drawing specifies walnut, any good hardwood will do equally well, and even good pine may be pressed into service. Pine, in fact, is especially effective if the piece is to be used in a room furnished in the Colonial style. Lay out the design for the end on a piece of stout paper marked off into ½-in. squares. It will be found easier to lay out if only half the design is drawn, then the paper folded along the center line of the design and the two halves cut out at the same time, thus keeping both sides symmetrical. The straight line along the bottom may be modified, if desired, by curving it down abruptly at the center to form a point about ¾ in. high. Lay this pattern on the wood and trace around the edges, or else stick it to the wood with rubber cement and use it as a pattern for sawing. It can easily be peeled off afterward, and the cement cleaned off with gasoline. The wood is sawed out on the bandsaw, or, if this is not available, with a turning or coping saw, and the edges smoothed with the spokeshave and sandpaper. A quicker method of finishing is with a small sander drum mounted on the lathe.



Right, Sawing the End on the Bandsaw; Left, Assembly of the Footstool, Showing Tacking Piece

The rails are 20 in. long, of ¾ by 1¼-in. wood, rabbeted, as shown, on one edge on the jointer or with the circular saw. This rabbet takes the edge of the cloth covering and the tacks that hold it. The edge that is exposed outside the covering should be ¾ in. wide to match the thickness of the ends. On the ends of each rail, cut a ½-in. square tenon, ½ in. long; these are later glued into mortises cut in the ends as shown in the drawing. Note that the mortises are cut on a line with the angle of the top line of the ends.

Coat the tenons with good glue, drive them into the mortises, test the assembly for squareness and clamp until the glue has set. Cut two curved pieces of ½-in. wood to the shape shown, and glue and brad them to the endpieces between the rails. These are to take the end tacks holding the covering. Cut a piece of three-ply wood to fit between ends and side rails to form the top. The edges should be cut at a slight angle, to make a neat fit with the side rails. Glue and brad the top in place. Coat the ends and rails with walnut stain and, when this is dry, give them a thin coat of shellac. After 24 hours, sand the shellac and coat with clear varnish or lacquer. When the varnish has set for 48 hours, rub down with pumice and rubbing oil, if a dull finish is desired. A fine gloss can be brought back, after the preceding operation, by rubbing with rottenstone and oil.

The upholstering is a simple matter. Lay several thicknesses of cotton batting on the top, gradually drawing and tucking it in and filling up any uneven spots until the general contour of the cotton conforms to the curve of the pieces glued to the ends. Then lay on the cloth selected for covering and fasten it temporarily with small tacks. When you have made sure that the pattern runs evenly, that the padding is uniform and that the cloth has been stretched with even tension, drive finishing tacks, 2 in. apart, all around the edges, removing any exposed small tacks as you proceed. The cloth should be turned under ½ in. all the way around, so that the tacks go through a double thickness. Place the rails on a firm surface when tacking, so as not to loosen the joints, and, if using long finishing tacks, drill a small hole for each tack before driving it home, to avoid splitting the wood. The holes should be about two-thirds the length of the tack shank. A finishing gimp may be used under the tacks, if desired.

Atomizer for Spray Painting

Good results obtained with the use of spray-painting outfits can be duplicated on a small scale with a similar outfit improvised from an ordinary perfume atomizer and an automobile pump. Remove the brass coupling from the pump hose and also discard the rubber bulb of the atomizer. It will be found that the hose fits nicely on the atomizer, and all you have to do is to fill the glass container with lacquer or paint. The container forms a natural handle while the pump is operated with the other hand. The outfit has been found excellent for lacquering small articles and is especially suitable for use with stencils in decorating furniture and making signs. To control the amount of lacquer passed by the spray, unscrew the container and pinch the end of the

Auto Pump and Perfume Atomizer Make a Good Improvised Spray Gun for Painting and Stenciling

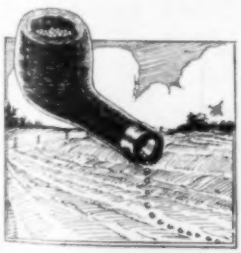
supply pipe slightly together as indicated, until it delivers the exact spray desired. If much spraying is to be done, a pint screw-top can should be substituted for the glass container, and the supply pipe must then be lengthened with a piece of brass tubing that is forced on so that it will be held by friction.

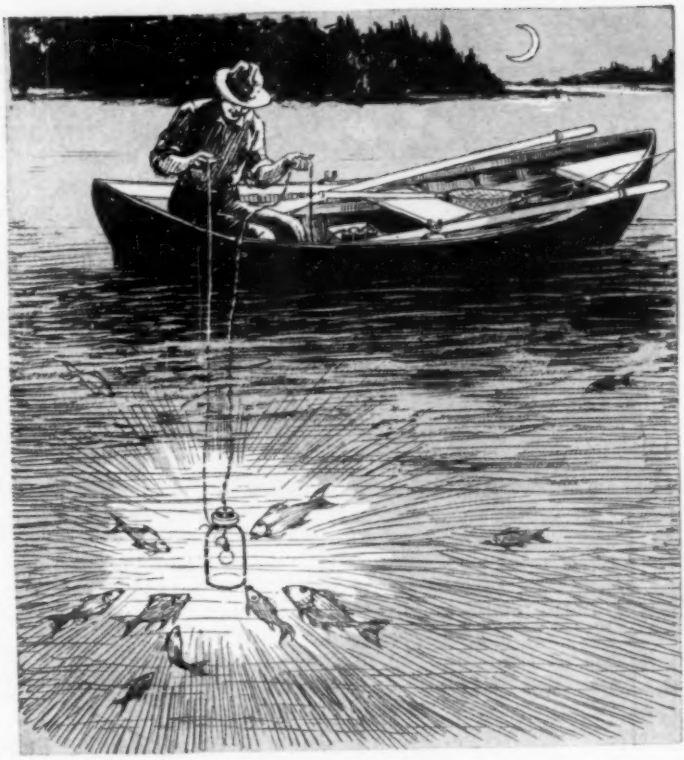
How to Keep Tools Free from Rust

To keep tools clean and bright, rub a little mercurial ointment over them, which will form a moisture-resisting coating. This ointment is somewhat poisonous, so should be handled carefully. Another good mixture to keep tools from rusting is made by heating six parts of lard and one part of rosin together slowly until the rosin is all melted. The heating of the mixture should be done in the open air to avoid danger in case of fire, and benzine added in about the proportion of 1 pt. to ½ lb. of the mixture. When cool, the mixture is rubbed lightly over the tools, which will resist the corrosive action even of salt water.

Old Pipe Distributes Seed

For distributing seed evenly, an old pipe can be used to advantage. First remove the mouthpiece, scald the pipe bowl in hot water and allow to dry for two days. Then put the seeds in the bowl. By tapping the pipe gently the seeds will drop out evenly as desired. For very small seeds insert the mouthpiece.—Geo. H. Holden, Chesterfield, England.





Use of an Electric Lantern Submerged under Water Will Attract Fish and Increase the Catch

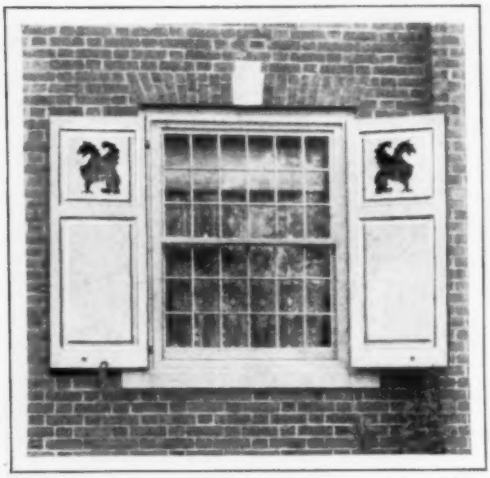
Submarine Lantern Attracts Fish

Lowered from the side of a boat, the submarine lantern shown in the drawing has been found to attract fish at night. It consists of a fruit jar through the top of which a hole is drilled for a rubber-covered electric cable. This connects to a 4-volt lamp on the inside of the jar and to three dry cells kept in the boat. The cable is cemented with waterproof cement at the point where it passes through the lid. The object is, of course, to increase the catch.—Jas. E. Noble, Toronto, Can.

Weight Keeps Clothesline Taut

By running a clothesline through a number of swivel pulleys instead of tying it to hooks, as is usually done, and providing a weight at one end, the line will be kept taut. Of course, the other end of the line must be securely tied and the weight must be heavy enough to counterbalance the wet clothes.—Cliff Deal, Santa Ana, Calif.

Cut-Outs Make Shutters Attractive

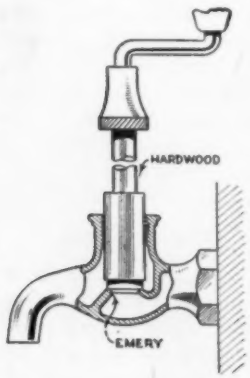


Artistic Cut-Outs in Window Blinds Involve Little Work with a Scrollsaw

Cut-outs of various designs, as shown in the photo, make window shutters more attractive. A stencil is made to transfer a design to the panel, and a scrollsaw is then used to make the cut-out. It has been found best to paint the shutters white so that the cut-out will show up in contrast to the dark background behind it.—H. Rossiter Snyder, Guilford, Conn.

Easy Way to Grind In Faucet Seats

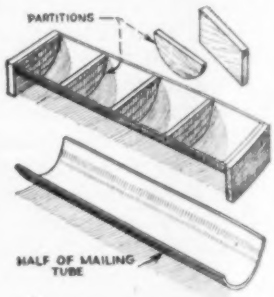
Brass faucets are often scrapped because they leak, although they are still in condition to be repaired. The cost of a new faucet may be $3 or $4, whereas, with a little emery, an ordinary brace and a round stick of hardwood, the faucet seat, which may only have a small dent in it, can be quickly reground, after which it will be as good as a new one. The hardwood stick should be about 10 in. long, with one end cut down to fit into the jaws of an ordinary brace. Remove the valve bonnet and stem and whittle down the wood until it fits loose enough into the faucet to allow it to turn easily. The end to be used for grinding must be flat and true. First apply some coarse emery, about No. 80, with a little water, and proceed to work the stick back and forth with the brace in the same manner as the valves of an automobile are ground. Lift the stick occasionally and drop in small pinches of fresh emery. Frequent examinations of the seat should be made. As soon as it is free from dents or deep cuts, repeat the operation with some very fine emery to remove any scratches made by the coarse emery, after which the faucet is thoroughly cleaned out, and reassembled with a new washer.—R. W. Tillotson, Erie, Pa.



Baseboard Blocks Save Bedroom Walls

It frequently happens that the walls in bedrooms are scarred through being hit repeatedly by the corner of the bed or the bedpost. To prevent this damage, attach a block of wood to the baseboard, about 6 in. above the floor, so that the bed will hit the block instead of the wall.

Mailing Tube Makes Good Desk Tray



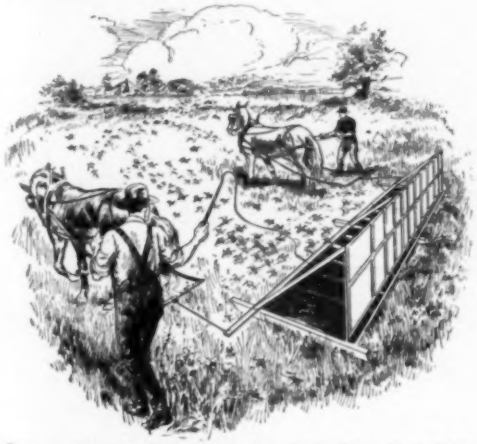
Cut in half lengthwise, an ordinary mailing tube has been found useful as a desk tray. Semicircular pieces of ¼-in. wood are cut to fit the inside and are tacked in place to form ends and partitions. Small rectangular pieces of the same stock are then tacked to the ends to serve as feet.—L. P. Young, Culver, Ind.

Charcoal Deodorizes Refrigerator

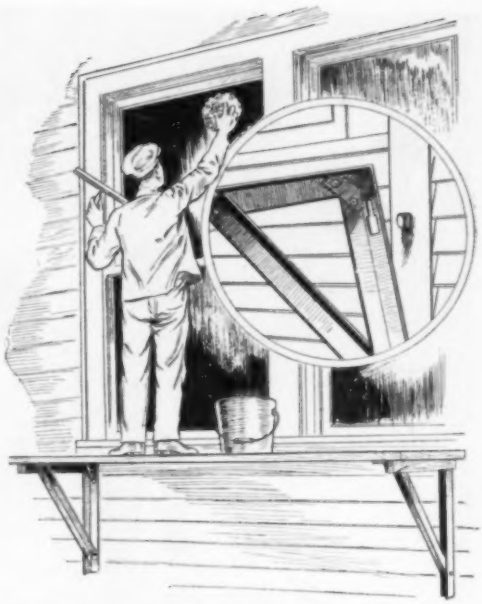
One of the most effective methods of eliminating undesirable odors which are sometimes characteristic of many electric refrigerators, is to keep some charcoal in the food chamber. A tea ball filled with fresh charcoal every two or three weeks will absorb all traces of objectionable odors and will prevent the resulting acrid taste in butter.

"Hopperdoser" Is Used to Exterminate Grasshoppers

In the mid-west states, where grasshoppers cause considerable damage to crops, one of the most effective methods of exterminating them is by using horse-drawn pans containing oil, as shown in the drawing. Such a device is called a "hopperdoser" and consists of a shallow metal pan, mounted on low sled runners, with a curtain or shield at the rear. The pan is usually made about 2½ ft. wide and 16 ft. long, rigidity being obtained by turning the edge of the metal over and soldering in partitions to brace it. The pan is filled with a mixture of water and oil to a depth of 2 or 3 in., and is then drawn through the fields infested with the insects. The curtain or shield is made of a strip of oilcloth, the glazed side facing the pan. As the device is drawn along, the insects take alarm at the passage of the horses and immediately rise. A large percentage is caught by striking the curtain and then sliding into the pan below. Many are able to leap out of the pan, but are covered with a film of oil which kills them in a very short time. It is quite usual to "harvest" bushel baskets full of the insects in a single day. The oil used for the purpose may be kerosene or old crankcase oil obtainable at garages, the owners of which are usually glad to cooperate with the farmers in exterminating the pest. Although this device seems rather awkward, its use has been found highly satisfactory.—C. A. Lovell, Hutchinson, Kansas.



Drawn through Infested Fields, This Pan Containing Oil, Exterminates Grasshoppers



Slotted Supports for Scaffold Are Slipped on Permanent Lagscrews in the Wall

Scaffold Supports from Angle Iron

For washing windows, the scaffold illustrated is much handier than a stepladder. Two large lagscrews are permanently located under each window or pair of windows, the heads of the screws projecting just far enough to engage with the slots cut in the scaffold supports, which are made of angle iron. In use, the supports are hung in place and the board laid over them, affording a safe platform for the worker.—V. P. McMahon, Chicago, Ill.

Preventing Silver from Tarnishing

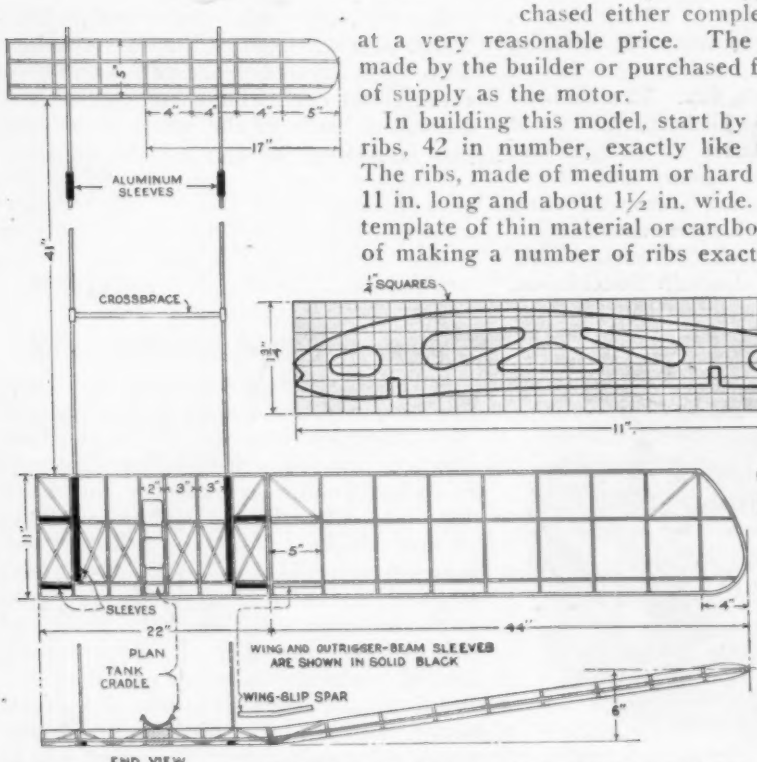
Silver vases, trophies, loving cups, etc., can be protected against tarnishing and the consequent necessity of frequent polishing by the following method: Ordinary household gelatine is soaked in cold water and dissolved with heat to the consistency of thin sirup. To this add sufficient ammonium or potassium bichromate to give a light lemon color. The objects are dipped in the solution and allowed to drain and dry in bright daylight. Due to the action of the bichromate, the gelatine hardens into a tough, invisible film, from which dust can be readily wiped, but which prevents tarnish. The effect will be found permanent.

COMPRESSED AIR IS POWER

By Joseph S. Ott

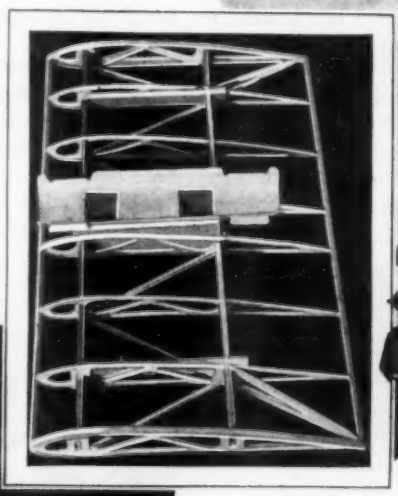
INTENDED for the advanced model maker, who wants something more realistic in the way of power for his ship than the conventional rubber-band motor, this eight-footer will give the constructor a real thrill. It demands a certain amount of skill and a lot of "flying sense," but tests have shown that it is a real flyer, considering the fact that the use of compressed air for powering model planes is as yet in its infancy. With its actual 8½-ft. wing spread, the plane weighs only 22 oz., complete with motor and tank. The motor used is a commercial three-cylinder type which can be purchased either complete or knocked down at a very reasonable price. The tank may either be made by the builder or purchased from the same source of supply as the motor.

In building this model, start by cutting out the wing ribs, 42 in number, exactly like the template shown. The ribs, made of medium or hard balsa wood, measure 11 in. long and about 1½ in. wide. First cut a full-size template of thin material or cardboard. A good method of making a number of ribs exactly alike is to lay out the shape on a piece of 1½-in. balsa, about 2 in. wide. Make the curved cuts on a jigsaw, if one is available, and then

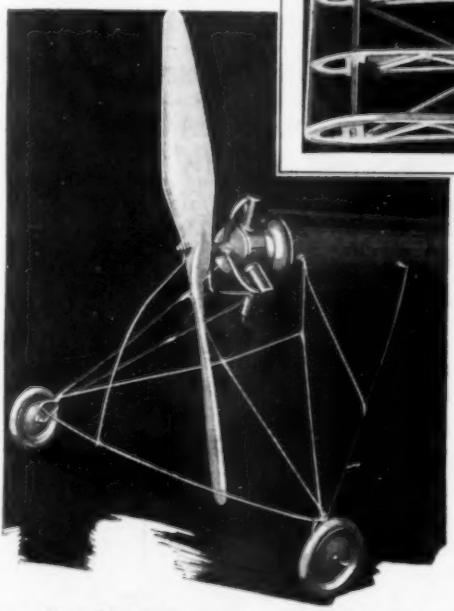


Part Plan and End View of the Skeleton Fuselage and Wing Section; Above, Rib Section Laid Out to Scale

FOR THIS 8-FOOT PLANE



cut the piece lengthwise in 1/16-in. widths on a circular saw. The cutouts can be made later, but care should be taken to keep the ribs as much alike in size, weight and balance as possible. When sawing out the ribs on the jigsaw, allow a little clearance so that the ribs will be slightly oversize, then sandpaper them down to the exact dimensions. Square notches are cut in the underside to take the



Center, Assembled Center Section of Wing Showing Tank Cradle; Below, Front View of Tank, Engine, Propeller and Landing Gear

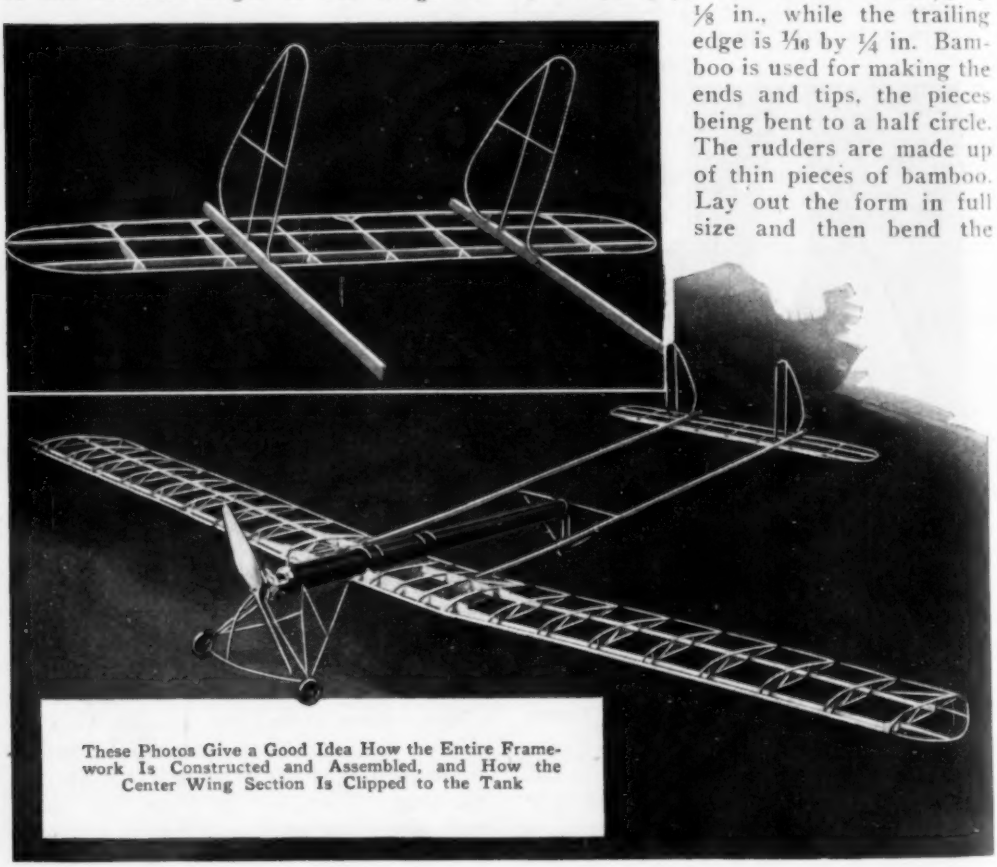
main spars, and a V-shaped notch is cut at the front, as indicated, to take the spar forming the entering edge of the wing.

After all the ribs have been completed, the center wing section, which is 22 in. long, can be built up by gluing the ribs onto the spars with ambroid cement. The spars should be 7/16 in. wide and 3/16 in. thick, and the ribs are spaced apart as indicated in the plan view. Glue on the entering and trailing edges, the former being 3/16 in. square, and the latter measuring 1/16 by 1/4 in. Crossbraces of 1/4 by 1/8-in. balsa strips are then fitted snugly and glued in place. The two end ribs are reinforced with a cap strip of 1/16 by 1/4-in. material, glued onto the edges, which greatly increases the strength of the assembly. The end ribs are set in about 8° at the top, so that the side sections of the wings, when butted up against this inclined edge, will have the proper dihedral angle to obtain the required stability for the ship. When set in place, the tip of each side wing section will then be about 6 in. above the underside of the center

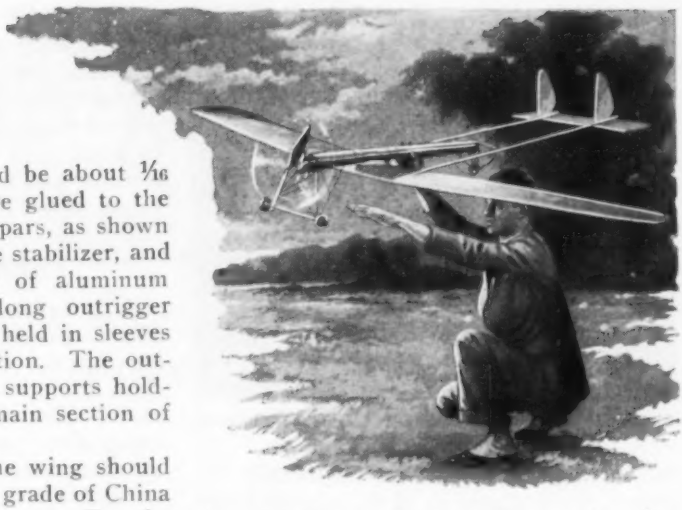
wing section. The joining of the wing sections will be taken up in detail later. The next thing to do is to build the side sections, following the same procedure as just described. A common mistake is to make both side sections exactly alike, which is entirely wrong; they should be made right and left-hand. The ribs are spaced 5 in. apart and the end ribs are again reinforced by cap strips. A piece of 15-in. bamboo, in its entire width as it comes, is bent over a candle flame to form the wing tips, the piece being split to size after bending. The best position to hold the bamboo is with its shiny side farthest from the flame. Do not hold the bamboo directly over the flame, which will burn it, but on the side of it.

The slip spars for the wings are 3/16 by 5/16-in. pieces of pine glued to the sides of the balsa spars, for about 5 in., and they extend about 5 in. outside of the wing. They are cut to a shape corresponding to the dihedral angle of the wings as shown in the detail between the plan and end views of the model. The slip spars fit into sleeves attached to the center-section spars in corresponding positions, as indicated in solid black. These sleeves can be made up of .015-in. aluminum, bent to fit the spars, or built up from pine, 1/16 in. thick. The fit should be moderately snug.

A cradle for the tank must be built, using .015-in. sheet aluminum, the cradle being cut and bent to the shape indicated in the plan and end views. Do not use any cloth or felt in this socket as it will have a tendency to slip. Ambroid is used to fasten the cradle to the wood. Be sure that the fit is fairly tight. The tailpiece or stabilizer is built up like a small swing, but has an inverted camber, that is, the underside is curved instead of the top. The exact shape of the curved side of the tailpiece is not important. The entering edge is 1/8 in. square. The first spar is 1/8 by 1/4 in., and the second 1/8 by 1/8 in., while the trailing edge is 1/16 by 1/4 in. Bamboo is used for making the ends and tips, the pieces being bent to a half circle. The rudders are made up of thin pieces of bamboo. Lay out the form in full size and then bend the



These Photos Give a Good Idea How the Entire Framework Is Constructed and Assembled, and How the Center Wing Section Is Clipped to the Tank

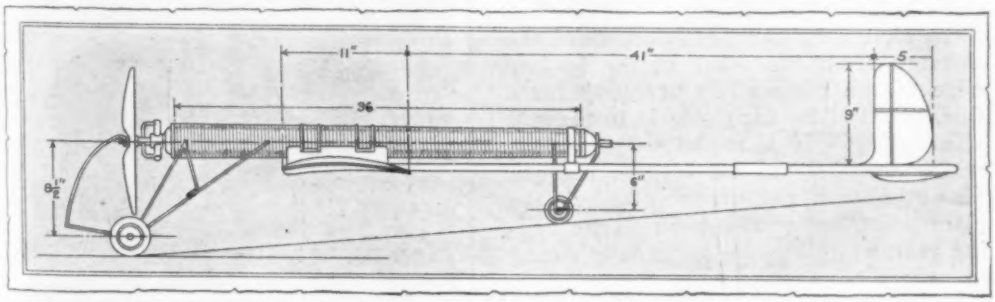


bamboo to the proper shape. By bending wide pieces and then splitting them, it is an easy matter to make them alike. The finished pieces used for making the rudders should be about 1/16 by 3/32 in. The rudders are glued to the top side of the outrigger spars, as shown in one of the photos of the stabilizer, and the spars fit into a pair of aluminum sleeves attached to the long outrigger beams, which are in turn held in sleeves provided in the center section. The outrigger beams are the only supports holding the stabilizer to the main section of the plane.

The center section of the wing should be covered with silk, a thin grade of China silk being used for the purpose. For the other parts, use Japanese bamboo tissue No. 9. This paper is very light and the strongest kind for its weight. After the wing sections and stabilizer have been covered, the paper and silk are given an application of dope. The silk-covered section will stand one or two heavy coats. A light coat of banana oil will be sufficient for the paper.

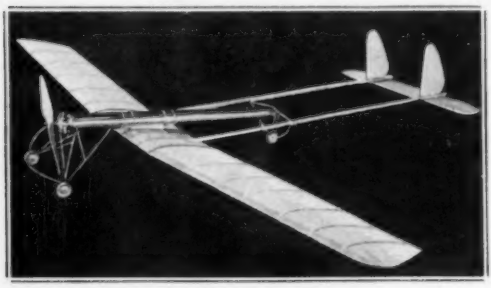
Spring sheet brass, .006-in. thick, is used for making the tank. The brass is rolled around a cylindrical wooden form, slightly tapered toward one end, as shown in one of the drawings. Make the tank 36 in. long, 2½ in. in diameter at one end and 2 in. at the other. The sheet brass for the tank is laid out on a smooth table or bench top, then wrapped snugly round the form, allowing 3/8 in. for a lap, which must be soldered. Do not use any acid, but only a good brand of paste which is guaranteed not to corrode. Also be sure to tin the edges carefully before soldering, as they will not adhere otherwise. After soldering, remove the form, which can easily be done, as it is tapered. Tank heads of the shape shown are then made and soldered on, and an air valve is fitted in the rear head as indicated. Thin piano wire, .01 in. in diameter, is wrapped around the tank the full length, spacing the wire 1/8 in. apart and soldering it in place on two sides. In soldering, be sure to keep far enough away from the tank seam so that it will have no tendency to open. At the forward end of the tank, a valve is provided to control the air supplied to the motor. This valve can be purchased at a model-airplane supply house.

Get some brass tubing, 1/16 in. in inside diameter and 3/32 in. outside. Three lengths of this tubing are to be passed directly through the tank to serve as sleeves for holding the ends of the landing gear. Drill 3/32-in. holes through the tank at points diametrically opposite each other and solder the sleeve in place. The exact posi-



Side View of the Plane, Showing the Point Where the Wing Fits the Tank; How Piano Wire Is Wrapped around It, and Where Landing Gears Are Attached

tion is not material, but they should be placed about as indicated in the side elevation. Put a pressure of about 40 lb. on the air in the tank and submerge it under



Finished Plane Covered with China Silk and Japanese Tissue Paper

water to test for leakage. Gradually increase the pressure to 90 lb., testing occasionally as you go along.

The landing gear is made up of 1/16-in. piano wire, bent to the shape shown in the photos. This wire is a little hard to handle, but has enormous strength for its size. The joints are wrapped with tinned music wire and are then soldered. One piece of wire is used for the rear-wheel frame. Allow about 3/8 in. at the ends of the frame to clip into the sleeves or sockets passing through the tank.

Care should be taken, when mounting the motor, to get the shaft straight in line with the line of flight. Balsa is used for making the propeller, or a propeller can be purchased ready-made. One can be cut from a block, 1½ by 1¼ by 15 in., beginning the cut about 2 in. from the center of the hub. When finished, apply two or three coats of dope sanding the surface carefully each time.

The assembly of the tank and the fuselage is facilitated by the use of rubber bands. Put all the tail parts in place and sight it for a final line-up. The finished plane should balance about one-third the distance from the front of the leading edge of the wing. The necessity for a 6-in. dihedral on each side is to prevent sideslipping. If a model sideslips, the wings are likely to hit first on landing. However, with the proper dihedral, the plane will usually come down on the landing gear, which is made sufficiently strong to sustain the shock.

Start out by making a number of low glides until the plane is correctly balanced, and then give enough air pressure to turn the propeller over rather slowly. Try to lengthen the glides in this way and increase the propeller speed gradually until a good flight is made. It should be kept in mind that this model cannot be used roughly and therefore good care must be taken to avoid breakage.

Preheating Camp Stoves

A little daub of "canned heat" jelly affords a cleaner and hotter flame for preheating the generator of a camp stove than does the ordinary gasoline. It will also be found a great aid in starting a camp fire, particularly in wet weather. A convenient way to carry canned heat, so that it is instantly ready for use, is to fill a collapsible tube with the jellylike substance. An empty shaving-cream tube will serve the purpose. The tube is unrolled, opened at the bottom, shaped into a cylinder, thoroughly cleaned and refilled with canned heat. The bottom of the tube is then folded several times and crimped tightly, and a supply of canned heat can be carried in convenient form.

Outboard Motor Propels Two Canoes

Two guides, appointed to transport two canoes loaded with camp supplies a distance of 20 miles, reduced the labor to a minimum by lashing the canoes together and mounting an outboard motor between them. A piece of 1½-in. board was lashed across the bows and another across the sterns, making a sort of crude catamaran. The trip was made in a short time.—Alfred Elden, Portland, Me.

Two Large Canoes, Lashed Together, Propelled by an Outboard Motor

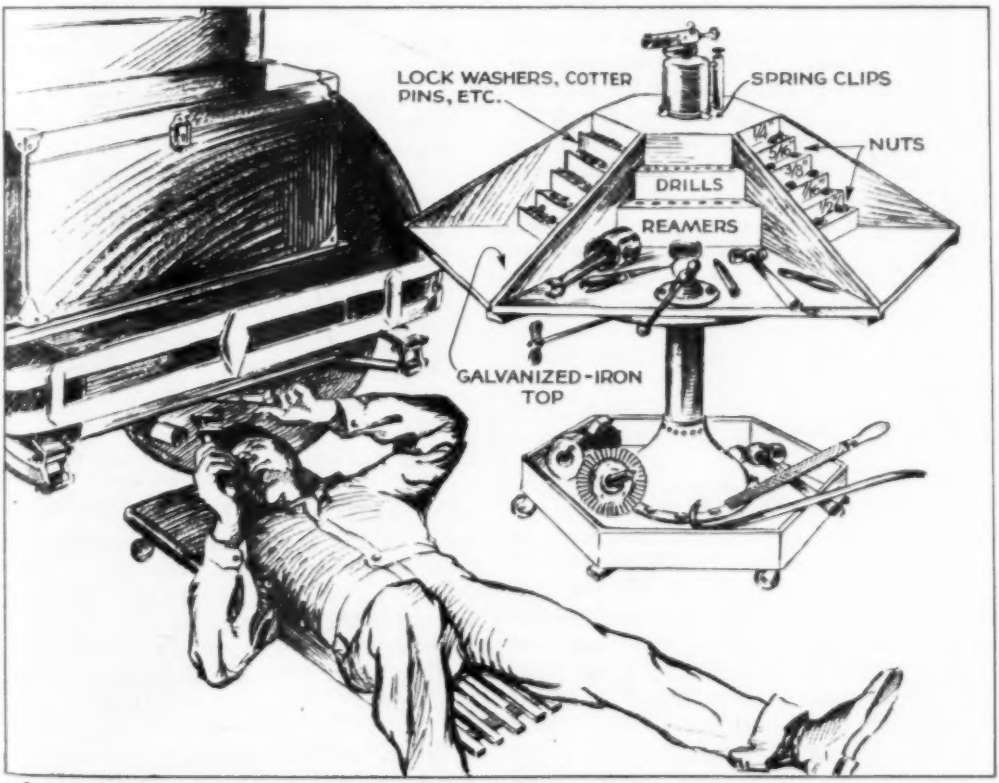
SHOP NOTES

Portable Bench Saves Mechanic's Time

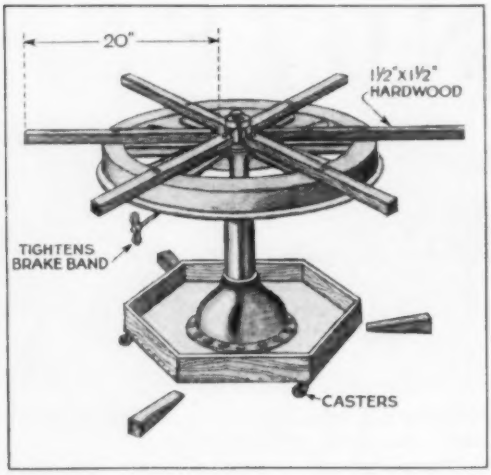
By DICK COLE

USUALLY a garage mechanic takes hundreds of steps a day between his job, the stockroom, the toolroom and the workbench. Many of these steps can be saved and greater working efficiency attained, if several completely equipped workbenches are provided for the shop, so that the mechanic not only can have all his tools, but most of his materials, right beside the job. The accompanying drawings show how such a bench may easily be made, at small expense.

The chief item required is one-half of a rear-axle assembly from a junked car, the full-floating type being preferable. The differential end is bolted to a substantial wooden base, which may be of hexagonal shape, as shown in the illustrations, square or circular, as desired. Four heavy casters are fitted as indicated. To



Instead of Taking the Job to the Bench, This Bench Is Taken to the Job; It Carries Often-Needed Supplies as Well as Tools, and Saves the Mechanic Many Steps



support the hexagon-shaped bench top, 1½-in. square hardwood stretchers are bolted to the face of the wheel. These should be about 20 in. long.

A hexagon box is fitted on the bench top, and triangular partitions, running from this down to the corners of the top, divide the bench into six compartments. On the sides of the box, in each compartment, containers for such commonly required supplies as nuts, washers, cotter pins, etc., are built, as well as for drills, reamers, wrenches, and similar small tools. At the edge of one bench compartment a vise is mounted.

The brake-band mechanism can be left in place on the wheel, and an extension rod with a thumbscrew on the end may then be used either to lock the bench to the standard, or to release it and allow it to be revolved. Three or four heavy wedges, carried on the base and driven under the bottom when required, make the whole outfit stationary for vise work.

Coloring Steel for Layout

After a piece of steel has been blocked out to the proper size for making a tool or a die, and is then coated with prussian blue or venetian red so that the scriber lines will show up clearly, one must be very careful not to touch it, to avoid erasing the lines. I have found a good method of eliminating this worry. Block out the steel in the usual way and clean it well with a piece of emery cloth. Then place it in a furnace, or put a piece of sheet steel or cast iron over a fire to prevent the fumes from reaching the work. Watch the steel carefully while it is being heated, and as soon as it has turned to a purple or blue, quench it in water and rub with oil. You can then use a scriber on it to make lines which will show plainly, and it will not be necessary to be so careful in handling and machining the tool.—H. K. Ellis, Cincinnati, Ohio.

Hardening Scraper Edges

When the edge on your scraper will not hold, or you have an extra-hard piece of metal to work on, re-dress the tool and harden it as follows: Heat to 1,450° F. or to a nice cherry-red, then push the cutting edge into a cake of common yellow soap to a depth of about ½ in. Let it remain there until it has cooled down to a black, and then quench in water at about 60° F. This will give you a glass-hard edge which is tough but not brittle.

Protecting Sucking Pigs

Often a mother sow will accidentally kill some of her offspring by lying on them. One method of preventing this is

Ledge of 4 by 4-In. Stock Protects Young Pigs from Being Killed by Mother Sow

to attach 4 by 4-in. beams to the inside walls of the pen, about 7 in. above the floor as shown in the drawing. I have found this arrangement an effective safeguard for the little pigs, as there is plenty of space for them to crawl under the protecting ledge.—C. M. Wilcox, Torrington, Conn.

¶When an inner tube is immersed in water to find a leak, make a mark around the hole with an indelible pencil.

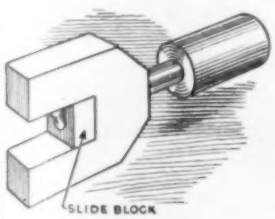
LAWNMOWER DISPLAY FOR STORE WINDOW

Draft from Electric Fan Rotates Blades of Lawnmower on Display in Hardware-Store Window

Something that moves always holds an attraction in a show-window display, especially if the source or cause of the motion cannot readily be determined. The drawing shows a window display of a lawnmower, which utilizes the draft of air from a 10-in. electric fan for turning the blades. A specially constructed box of cardboard, plywood or sheet metal conducts the draft from the fan and directs it against the upper portion of the mower blades from a position behind the machine. Carefully note the shape and construction of the box, which does not only serve to direct the draft but also to hide the fan from view. If desired, ribbons may be attached to the stationary parts of the mower, but these will betray the presence of a draft. If the blades will not turn readily, loosen the stationary knife as required, then, to make the blades turn still easier, remove the dogs on the end of the knife shaft. A good grade of light oil is put on the bearings to reduce the friction to a minimum.

Push-In Handle for Snap Gauge

The purpose of the handle shown in the drawing is to prevent the snap gauge from being pushed too forcibly on the work, which soon destroys the accuracy of the gauge. The handle is movable in a hole drilled in the gauge and carries a square block, which is accurately made to a sliding fit on the gauge. Thus, if any attempt is made to force the gauge on the work, the block will slide forward and check it, but will not move if the gauge is tried on the work with ordinary pressure because the work then offers less resistance to the gauge jaws than the block.—Harry Moore, Hamilton, Can.

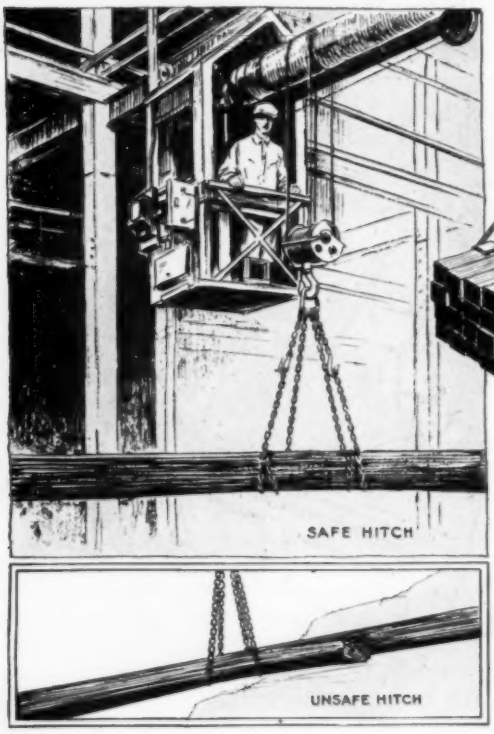


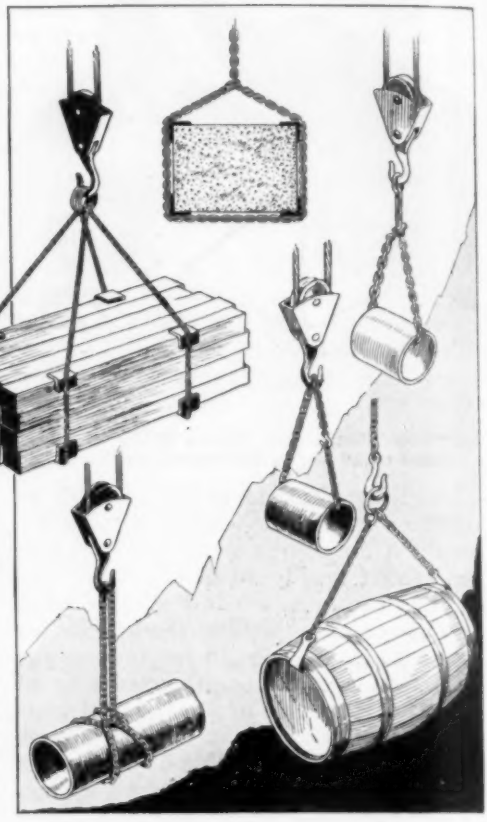
Brown Stain for Mahogany

When staining mahogany, it is sometimes rather difficult to get a rich brown without a slight reddish hue. If such a hue is not desired, try the following solution: Mix 1 pt. of walnut stain and ½ pt. of weathered-oak stain. Apply with a brush wide enough to cover the work rapidly and evenly, and then wipe off the surplus stain with a cloth.—L. H. Georger, Buffalo, N. Y.

EXPERT TELLS HOW TO SLING LOADS FOR SAFETY

When a sling is used to lift a load having sharp corners, it should be protected against being cut by means of pads of





burlap, or, better still, wooden corner pads. The sling should be sufficiently long to leave a considerable space between the top of the load and the point of suspension. The point of the sling hook should never be inserted in a link of the sling, throwing all the strain on the point of the hook. The hooks are not designed for such service and the point may be bent open or broken by this practice. Sling chains should be provided with one or more large rings to engage with the hook or else the chain should pass through the belly, or saddle, of the hook. The best method is to use an endless chain, wrapping it around the object to be lifted and passing the top of the sling through the belly of the hook. If an endless chain is not available, use a chain having a ring at one end and a hook at the other. By passing the hook into the ring it will serve the purpose of an endless chain. Two chains of equal length, with rings at the ends, make a good sling. The four rings may then be held together by means of a larger ring engaging the hook, or the four rings may be engaged directly with the hook. For special kinds of work, special chains should be used, such as barrel slings, etc. Besides taking care not to pass chains over sharp edges without using protective pieces, chains should be free from knots and twists. The load should be lifted gradually, as a sudden strain is likely to snap the chain.—David Fliegelman, Worcester, Mass.

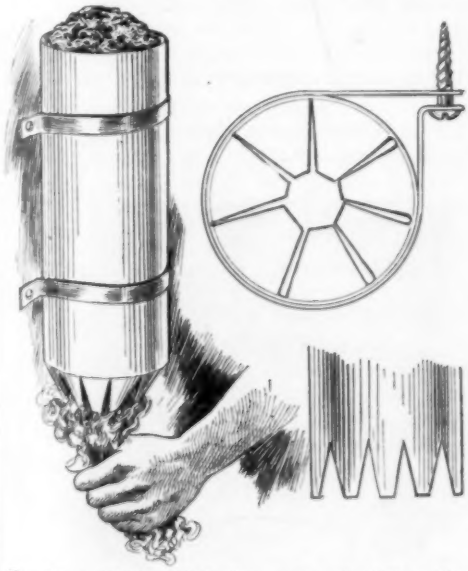
Measuring Screw Threads

The old method of measuring the thread with a pair of broad-nosed calipers to go over two or three threads has given way to the better plan of measuring halfway down the sides of the thread. Measuring

the top gives the outside diameter, but the threads should fit on the sides and not the top and bottom. The bottom of the thread depends entirely on the point of the threading tool, while the top depends on whether the cut is brought up so as to be just sharp in a V-thread or to the right width of flat for the U. S. standard. But measuring the sides of the thread tells the story. Of course the most refined and accurate measurements are made by the use of wires laid in the threads, or else with a special thread micrometer, but for lathe work, grind the points on a pair of calipers so as to touch the sides of the thread, about halfway down, and then measure a bolt that has the proper thread on it. Using this as a standard, you will be surprised to know how accurately you can cut threads, if the angle is kept right.

Waste Holder for the Garage

Dry waste can be conveniently held in a container made from a 2-ft. length of stovepipe. Triangular pieces are cut out of the lower end and the remaining sections are bent inward to retain the waste. Sheet-metal straps, screwed to the wall, hold the container in position. In use, the waste is removed through the bottom, the turned-in edges making it convenient to pull out just the quantity required.



This Waste Holder, Made from a Length of Stovepipe, Is Handy for the Garage

Adjustable Extension Leg, Fastened to Ladder with Clamps, Can Be Used on Uneven Ground

Extension Leg for Ladder

Painters and others who use ladders will find the illustrated extension leg useful on uneven ground. Two flat-iron guides, bent to the shape shown in the detail, are bolted to each leg, to receive a sliding piece, which can be clamped in place with thumbscrews on the guides.

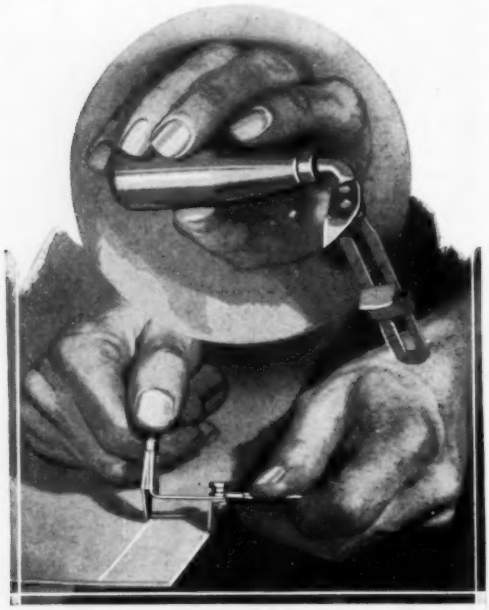
Pipe Nipple Aids in Starting Wood Screws

Often it is difficult to start a wood screw straight because it wabbles under pressure of the screwdriver. A helpful device in such cases is a short pipe nipple of which the inside diameter is just large enough to slip over the end of the screwdriver and over the screw. In use, the screw is placed in position and the screwdriver, with the nipple slipped over it, is then engaged with the screw, after which the nipple is dropped down over the screw. Hold the nipple with the left hand while driving the screw home with the right hand.—John E. Hyler, Peoria, Ill.

¶When scouring steel cutlery, use a cork instead of a cloth; it will wear longer.

Tool for Cutting Strips

For cutting uniform strips of material, such as leather, the adjustable-gauge



Adjustable Stop on Knife Aids in Cutting Uniform Strips of Material

knife shown in the drawing will be found handy. It is homemade and consists of a short blade riveted to a shank which is bent over at right angles and driven into a suitable handle. A strip of flat metal, with a slot cut lengthwise in it, is either soldered to the shank to which the blade is attached, or riveted to it with the same rivets as the blade. The slotted piece is bent over at right angles and a stop is provided which can be slid along and tightened at any point with a thumbscrew.

Aids to Lubrication of Ford

Some of the grease fittings on the model-A Ford car are not easily reached by the hand-pressure gun furnished with the car. Since some owners wish to do this work, a few changes will prove helpful. The nipple on the lower steering-spindle bushing is hard to reach. One of the 65° drive nipples, such as are used on the upper bearing for the spindle, may be installed here and will make lubrication easy. The fitting on the front end of the drag link is also in a hard place to get at. A 65° threaded fitting should be turned in and left pointing upward. The universal joint takes quite a large amount of grease, and should have a pipe extension applied and run forward on top of the motor-support arm under the hood. The rear-wheel bearings should have 65° or 90° threaded fittings screwed in with the openings toward the rear. Because of the large fenders, the spring shackles and rear-wheel brake shafts are hard to reach without going under the car. If the wheels are removed, they can be reached by the hand gun without going under. The only places now left under the car are the two nipples on the throw-out shaft through the clutch housing, which are on all of the cars. Some cars have one on each pedal and one on each end of the cross shaft for the hand brake. When filling these, it is best to go under the car from the left-hand side.

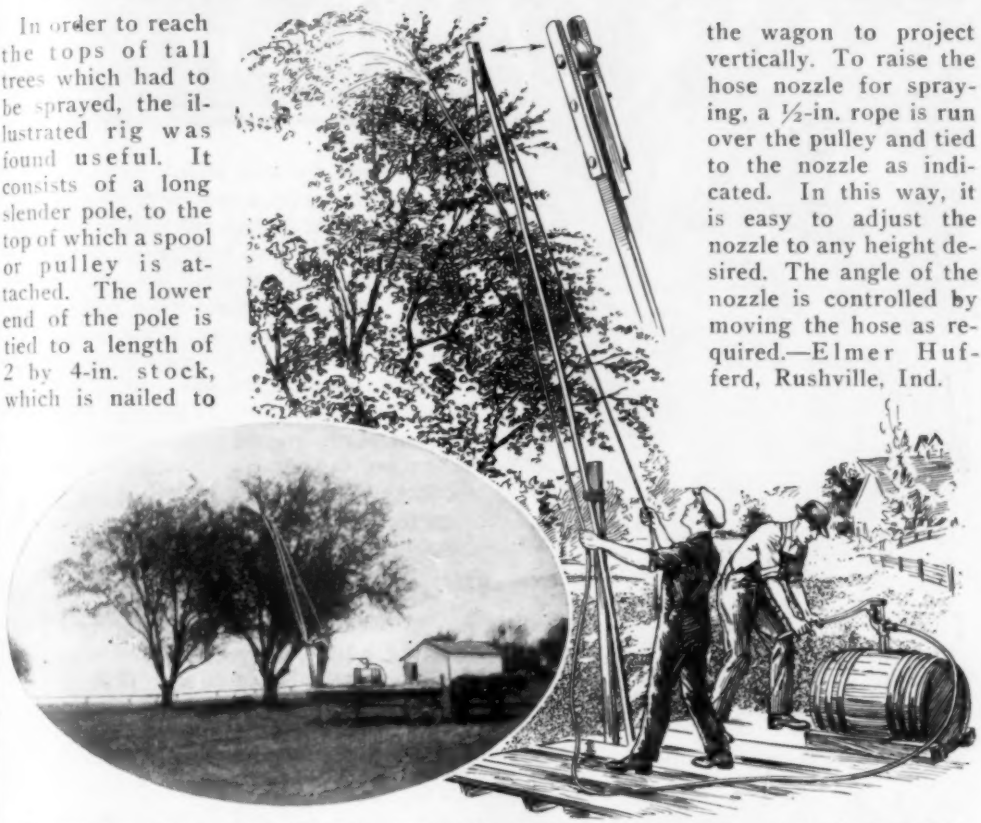
Traveling Chair Aids Workmen

Certain tasks in factories can often be better performed when the workman is seated. However, in cases where it is necessary for him to move along the bench, the traveling chair shown in the photo will be found convenient, as it can be rolled along on a track. A ready-made chair can be adapted to the purpose by using only the seat and backrest, or a chair can be made to suit the requirements. Four 4-in. rollers are attached to the underside of the seat to fit the tracks. The latter have strips of 1-in. wood nailed to the sides and projecting over the top to keep the wheels on the track.

Seat on Rollers That Will Slide along the Entire Length of the Workbench

SPRAYING TALL TREES IS EASY WITH THIS RIG

In order to reach the tops of tall trees which had to be sprayed, the illustrated rig was found useful. It consists of a long slender pole, to the top of which a spool or pulley is attached. The lower end of the pole is tied to a length of 2 by 4-in. stock, which is nailed to the wagon to project vertically. To raise the hose nozzle for spraying, a ½-in. rope is run over the pulley and tied to the nozzle as indicated. In this way, it is easy to adjust the nozzle to any height desired. The angle of the nozzle is controlled by moving the hose as required.—Elmer Hufferd, Rushville, Ind.



Tree-Spraying Hose Can Be Raised to Any Desired Height with the Aid of a Pulley, Rope and a Long Pole Rigged as a Light Derrick, on a Flat-Bed Wagon Which Carries the Barrel and Pump

Satin-Finishing Aluminum

To satin-finish aluminum, buff the article if necessary in order to obtain a good surface, and clean off the grease in benzine. Then dip it in a scalding solution of hot potash, not too strong, until the surface is dull and white. Rinse in cold water and soak for 5 or 6 minutes in a 5-per-cent solution of hydrofluoric acid to soften the surface. Then rinse again and dip into a mixture of equal parts of nitric and sulphuric acid to remove the discoloration. After this, rinse again in cold water and in clean hot water. Dry the article in sawdust of good quality and free from pitch or gum. Boxwood or birch sawdust should be used if possible. Care must be taken not to touch the aluminum at this stage with the bare hands, as this makes stains. The frosting is accomplished with a fine, soft steel-wire scratchbrush, about 6 in. in diameter, and running about 2,500 r.p.m. New brushes should be broken in on coarse work or by running them against a file.

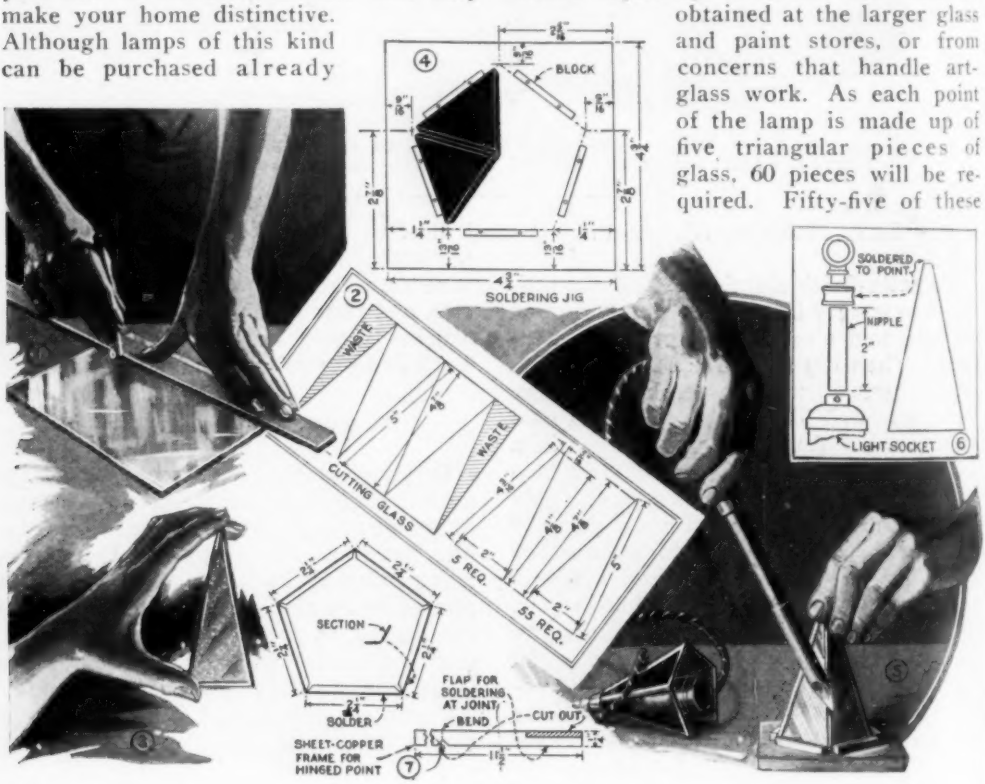
Protecting Drawings

Ordinary transparent lacquer used for coating brass and other metals can also be applied to paper reference sheets, tables, drawings, etc., to protect them from being soiled by handling. The lacquer is poured into a shallow tray, and the sheets are dipped so that both sides are thoroughly coated, then hung up to dry. The lacquer covers the paper without affecting the printed matter, and it toughens and glazes the surface.

STAR LAMP ADDS

UNUSUALLY odd and attractive, the twelve-point star lamp shown here, is just one of those ornaments that help make your home distinctive. Although lamps of this kind can be purchased already made up and wired, many a home owner with a modest purse does not feel that he can afford one and so he does without, buying a more or less satisfactory substitute. However, if he knows how to handle a glass cutter and a soldering iron, he can make a very fine star lamp himself. It is not very much of a job to do this and the work affords an interesting pastime. If he does not desire to cut the glass himself, he can, for less than five dollars, buy a complete outfit in knocked-down form, including the soldering jigs, so that all he has to do is to solder the pieces of glass together and wire the lamp.

Almost any kind of glass that the maker fancies can be used. An antique glass, having a light olive-green color, has been found especially suitable. This can be obtained at the larger glass and paint stores, or from concerns that handle art-glass work. As each point of the lamp is made up of five triangular pieces of glass, 60 pieces will be required. Fifty-five of these



BEAUTY TO HOME

are cut in the form of true triangles according to the dimensions given in Fig. 2, while the other five have the narrow end or apex cut off as indicated, so that, when assembled, an opening is left at the top for the insertion of a nipple which holds the light socket. Obviously, this point will be the uppermost one on the lamp and a fixture ring at its end provides a means of fastening it to a chain or other fixture.

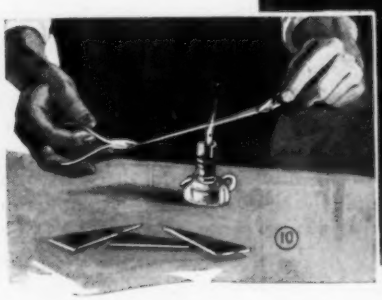
The correct method of cutting the glass is shown in Fig. 1. Hold the cutter vertically, using a straightedge as a guide. Dip the cutter in turpentine to make it bite. It requires quite a bit of care to cut the glass, or rather to break it off evenly along the scratch made with the cutter. For this reason it is a good idea to practice on scrap pieces of ordinary window glass until you get the knack of doing it with little or no breakage. After all the glass has been cut, the edges must be bound with copper foil or very thin copper-shim stock. This should be about ¼ in. in width for ordinary single-thickness glass. If the glass is thicker, it will be necessary to use wider strips. Before bending them over the edges, cement should be applied, which can be made by melting together a lump of beeswax, about the size of a hickory nut, and two tablespoonfuls of fir or Canada balsam. After the mixture has cooled, it should be rather hard, yet noticeably

The Completed Star Lantern Is Shown at the Upper Right, Used over the Bottom of a Stairway

sticky to the touch. Without cement it is impossible to make the foil adhere to the glass. A good method of applying the cement is as follows: Over a gas flame, warm up a metal plate, which is at least ⅛ in. thick, in order to hold the heat. Two or three sheets of newspaper are laid on the plate and the foil is then laid on the paper. Melt the paste and apply a thin coating to the foil with a brush or piece of rag. Lay the foil with the coated side down on an old magazine, and cut it into strips of suitable width with a sharp knife, as shown in Fig. 9. Next put the strips on the edges of the glass. In doing this, it will be noticed that by repeated bending, the foil will become hard and brittle. In this condition it is easily broken and to restore the copper to its original softness, it must be annealed, which is done by heating to a cherry-red over a small alcohol lamp, as shown in Fig. 10, and allowing it to cool in the air. If the metal is so stiff that it will not bend easily or lie flat, follow the same procedure of annealing. Care should be taken to get the foil applied as evenly around the edges as possible, so that it will project about 3/32 in. on each side. Fig. 3 shows a piece of glass completely bound and ready for soldering.

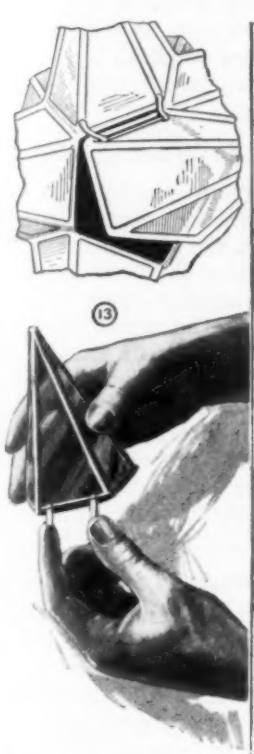
A soldering jig, for holding the pieces of glass in their respective places for assembling, consists of five short strips of wood tacked to a base to form the sides of a pentagon or figure of five equal sides. Fig. 4 gives the exact arrangement and dimensions of the jig, and Fig. 5 shows how it is used. The copper-bound pieces of glass are placed against the blocks on the jig, so that the edges of the glass pieces will butt together evenly. Be sure to have the pieces come together so that, when viewed from the outside, there will be a V-shaped channel, which is later filled with solder. Do not let the edges overlap, as this throws the points askew. Apply a little soldering paste and first "tack" two pieces together at two points along the edge. Then tack the remaining three pieces on in the same way, so that all five pieces will form a unit that can be removed from the jig without risk of coming apart.

It is necessary to apply flux before soldering in order to make the solder adhere to the metal. A good paste flux should be used instead of an acid flux, as the latter is corrosive and will, in time, eat through the copper foil. The point, which is now only tacked together, must be completely soldered. To do this the point is held in such a position that the edge being soldered is perfectly horizontal, permitting the solder to be run in the groove evenly. For this purpose a second jig will be found convenient. It consists of a base with two pieces of wood nailed on at right angles, as shown in Fig. 8. The apex of the point is placed on the highest block, while the base is set against the short block that



serves as a stop and prevents the point from slipping out of horizontal. The grooves between the adjacent edges of glass are then filled with solder, using a heavy pointed iron. Apply the solder roughly at first and then smooth it off, drawing the iron from the point to the base with a slow, steady movement. Remember not to hold the hot iron against the point any longer than is absolutely necessary, or the glass will crack. Also, large drops of melted solder coming in contact with the glass are to be avoided for the same reason. After the outside edges have been finished, the inside edges are carefully gone over. Usually it will be found that more or less solder has run through from the outside and merely needs to be run smooth.

After all twelve points have been finished separately, the inside of each point should be thoroughly cleaned with a rag saturated in gasoline or other cleaning fluid. Do not postpone this job until the lamp has been partly or completely finished, for you will then have considerable difficulty in doing it. After being cleaned, the points are assembled, which is done by tacking the base edges together at the corners. This permits the points to be twisted slightly in fitting them to adjacent points. Some assistance may be necessary in getting the first three points together accurately.



As previously mentioned, one point has its end cut off to allow the insertion of a nipple to which the light socket is attached. The top edge of this point must be covered with copper foil in the same way as the other edges, and a nut soldered on. A keyless light socket is wired and a 2-in. nipple is screwed into the cap nut. The wire is first run through the point from the inside, and the nipple is then turned into the nut so that it projects about ¼ in. on the outside. The top ring nut is then screwed onto the projecting nipple. Figs. 6 and 12 show the method of assembling these parts. Be sure to fit the socket in place before soldering the top point to its neighbors, or you will have difficulty doing it later. An opening must also be provided for inserting a lamp. This is done by hinging a point adjacent to the top one, as shown in Fig. 13, so that it can be swung up to get at the interior.

The weight of the hinged point will keep it shut. The hinge pin is made by solder-

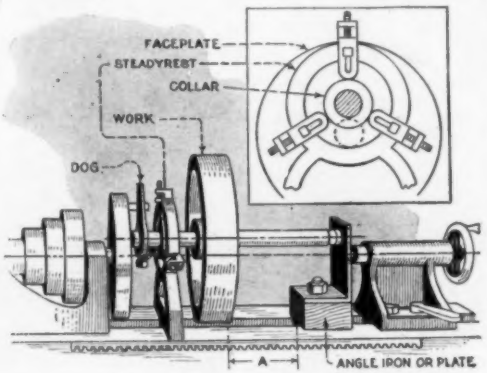
ing a piece of stiff brass wire to opposite sides of the point, and the hinges are formed from two strips of thin sheet copper, bent around the pin as shown in Fig. 14. A frame for the hinged point or door is also required. This can be made by bending a ¼-in. strip of sheet copper over at right angles throughout its entire length, after which it is formed to fit the base of the point. Fig. 7 shows how this strip is notched at points 2¼ in. apart, to facilitate bending, and how the ends are cut out to make a smooth joint when fitted together. After the frame is finished, it is soldered to the five adjacent points, around the opening. The door point is inserted into the frame and the hinges bent around and soldered to the side edges of the point containing the lamp assembly, as shown in Fig. 13. After the lamp has been completed, clean the outside with a gasoline-saturated rag to remove soldering paste and fingermarks. The soldered edges will be shiny at first but will soon become dull and will then closely resemble lead. There are many uses for such a lamp, a few of which are shown in the illustrations. It is especially suitable for hallways, vestibules, porches, and may even be used for a bridge lamp.

Truing Work in Worn Chuck

When operating on particular work with a three or four-jaw universal chuck that is out of true, the difficulty can be remedied without using shims, as follows: Place a piece of tubing, having an internal diameter suitable to the work, between the jaws, and tighten them up equally, so that the tubing will be bent slightly out of round. Bore the tubing out to the size of the work. Then insert the work and tighten the jaws, and the work will run perfectly true. The tubing will not turn in the jaws.—J. Harger, Honolulu, H. I.

Crowning Large Pulleys in a Small Lathe

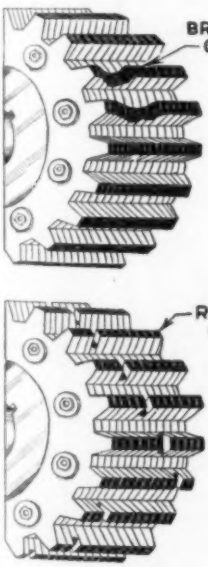
When about to crown some pulleys too large to swing in a lathe, which was not equipped with blocks for raising the head and tailstocks, the method illustrated was employed. The pulley was pressed on an arbor of sufficient length to accommodate a steady rest and a straight-tail dog on the end nearest the faceplate, while the other end turned on an improvised center consisting of an angle iron set on a block bolted to the lathe bed. A cast-iron collar, bored to a running fit on the arbor, was clamped in the steady rest to form a bearing. A bolt was attached to the faceplate to drive the dog. As the center of the faceplate was lower than that of the work, it is evident that the bolt on the faceplate would slide along the edge of the dog while driving it. This, of course, gave a variation in the speed of the work, but that was not important.



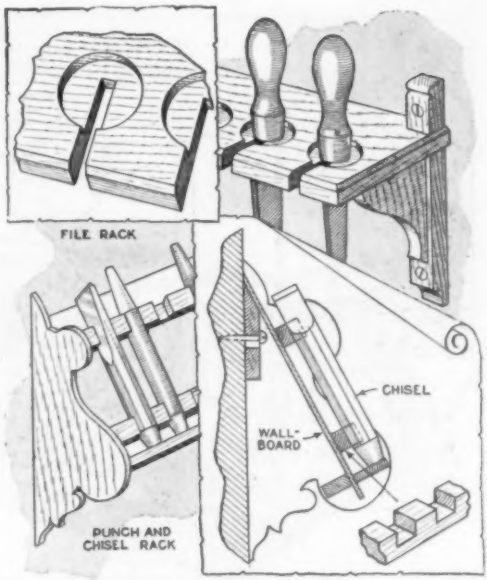
Cleaning Greasy Clutches

One of our heavy derricks, which was of the cone-clutch type with wooden friction blocks, caused considerable trouble by the blocks not taking hold when the levers were operated, because oil had saturated their surface. This trouble made frequent renewals of the blocks necessary. It happened, one day, that a lighted match was carelessly thrown into the machine, igniting the oil. To extinguish the flame, the operator used the fire extinguisher, which was filled with a solution of carbon tetrachloride. In doing this, the solution was also squirted over the blocks. When the machine was again used, they took hold as if new, the solution having dissolved the oil on their faces. A large can of the solution was then used to clean the friction blocks whenever necessary. The solution has also given good results in cleaning greasy automobile clutches and oily brake bands. It is much better than gasoline or kerosene, and, of course, safer than these, because it is not inflammable.—A. S. Jamieson, Springfield, Mass.

Repair for Rawhide Gear



A rawhide gear can readily be repaired if one or two teeth have been worn or broken. The nuts and end plates holding the assembly together are first removed. The layers of rawhide are then pried apart and rearranged so that the layers containing the worn teeth are staggered across the width of the gear and distributed over its entire periphery. When assembled again and bolted together the gear is nearly as strong as a new one.—E. N. Davey, Vancouver, Can.



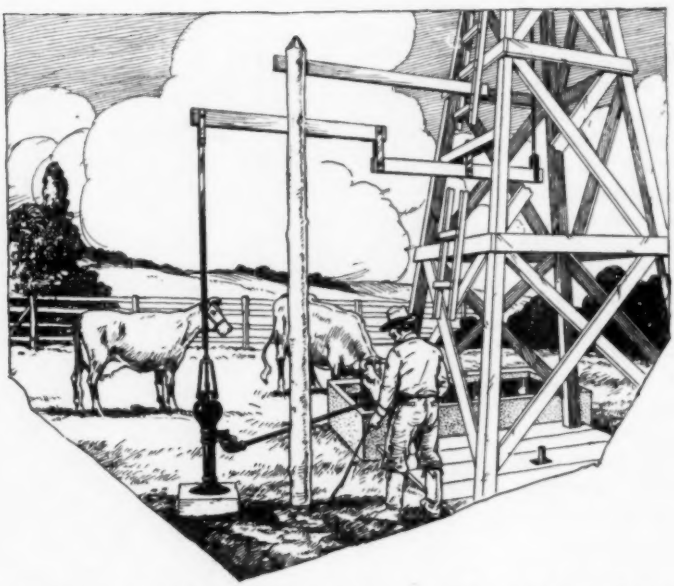
These Handy Racks Will Hold Tools Securely, Even under Heavy Vibration

Tool Racks for the Workshop

For holding files, punches and chisels, the racks shown in the illustration have been found highly satisfactory. A horizontal shelf for the files is counterbored on the top at regular intervals, and a slot is run to the center of each counterbore. The tools will not readily be dislodged by vibration, as the handles are seated in the counterbores. The punch and chisel rack has a shelf arranged at an angle with two strips of 1 by ½-in. wood running along top and bottom, these being notched to hold tools.—G. H. Cappel, Wilmer, Ala.

Drilling Hardened Steel

I have found the following method for drilling hardened steel very satisfactory: The pointed end of the drill is ground to a half-round shape, then made as hard as possible. The surface to be drilled is etched with diluted muriatic acid. Instead of oil, turpentine or kerosene, in which a little gum camphor has been dissolved, is used as a lubricant. Should the bottom of the hole become polished, so that the drill rides over it, remove the drill, etch the bottom of the hole with the acid and proceed as before.—Wm. J. Edmonds, Rutland, Vt.



Arrangement by Which Old Windmill over Dry Well Is Made to Operate New Well Sunk Eight Feet Away

Old Windmill Pumps New Well

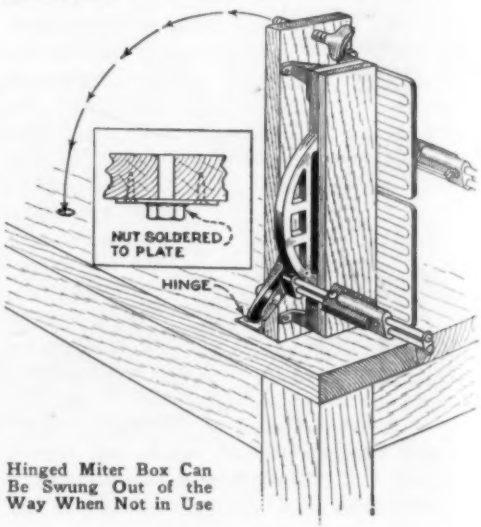
After an old well ran dry, a new one was sunk about 8 ft. away. Moving the windmill over the new one involved too great an expense, so a double walking beam was improvised, which made it possible for the windmill to operate the new well efficiently. The beams were made of hardwood connected and pivoted with links of heavy flat iron, while a mill plunger rod was pivoted to the end of the outer beam and to the pump plunger. A crosspiece on the windmill was used to pivot the first beam while a sturdy pole braced to the windmill served to pivot the second beam. All details of construction and assembly are clearly indicated in the drawing.—Dale R. Van Horn, Lincoln, Nebraska.

Changing a Ball-Bearing Fit

A bearing had to be ground out to fit a shaft that could not be turned to fit the ball bearing. The construction of the bearing was such that it could not be taken apart, and it had to be held in the grinder by the outside raceway, which ordinarily would leave the balls and inner race free to turn. As wedges would force the inner race out of true, I decided to try a filler. The bearing was laid on a faceplate and paraffin was poured into the space between the balls. After cooling, the paraffin held the balls and inner race securely so that the bearing could be chucked and ground to the required size.—Ernest Romkee, Colorado Springs, Colo.

Hinged Miter Box Can Be Swung Out of Way

Many workers who have limited space on their workbench, will find the hinged arrangement of the miter box a convenience, as it can be swung out of the way when not in use. A large butt hinge is fastened to one end of a piece of 2 by 6-in. stock on which the miter box is mounted, and to the bench top. In order to insure rigidity while being used, the miter box must also be fastened to a bench top at the loose end. This is done by means of a thumbscrew slipped through a hole in the miter-box base and then driven through a nut soldered to a plate, which is fastened to the underside of the bench top as shown.—John E. Bostow, Flint, Michigan.



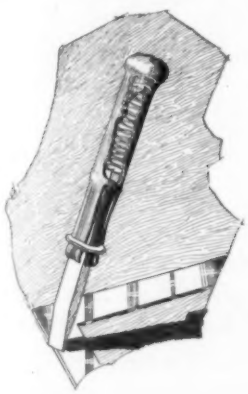
Hinged Miter Box Can Be Swung Out of the Way When Not in Use

Balls in Brake Drums Cause Noise

The rear wheels of my car were equipped with external contracting brakes, which produced a peculiar shrill hum, similar to a dragging band, when a speed of 15 miles per hour was reached. Repairmen, who adjusted the brakes for me, predicted that this noise would cease as soon as the roughness of the band had worn down. However, the noise continued, so I had both wheels removed. Inside of the brake drum a number of hard balls, amalgamated from road dust, rust and oil, were found, the largest being ¾ in. in diameter and weighing nearly an ounce. The balls were removed and the wheels then replaced, after which no more trouble was encountered.—Elton Sterrett, Savannah, Georgia.

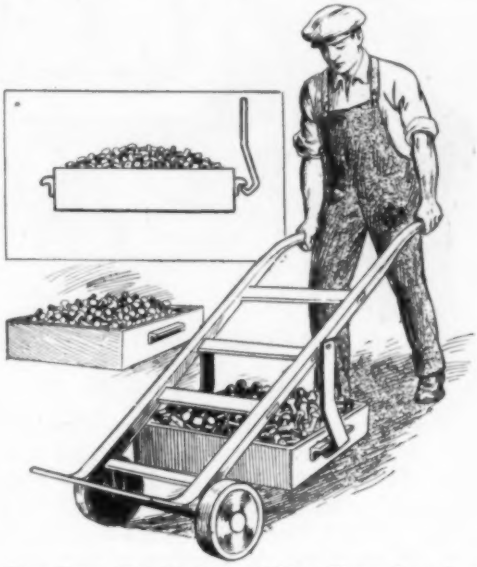
Handy Soapstone Holder

The illustrated soapstone holder is a shop convenience of proved merit. It is made from a piece of sheet brass, bent to form a rectangular tube. The adjoining edges are soldered together, a slot is cut down each corner and the ends are bent inward to form jaws, which hold the soapstone tightly by means of a ring. When the ring is slipped up the jaws are released. The top end of the holder is closed and fitted with a coil spring to exert pressure on the stone, eliminating the trouble of pulling it out as it wears.—Joseph Chmelar, St. Louis, Mo.



Truck Transports Boxes Horizontally

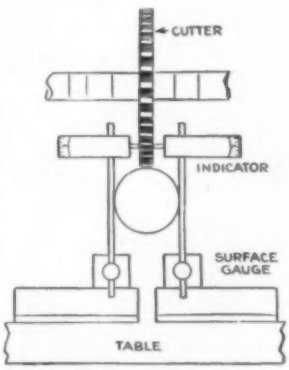
For transporting heavy boxes in a horizontal position on a shop truck as shown in the drawing, two hooks are attached to the handles. The hooks are pivoted to the handles and the lower ends are bent to fit the pan grips. As most of the pans in any shop are of one size no difficulty will be experienced in fitting the hooks to them. In use, the truck is lowered until the hooks can be engaged with the grips and the truck handles are then raised to lift the pan from the floor.—F. C. Wegener, Indianapolis, Ind.



Shop Truck Has Hooks for Lifting Heavy Pans in a Horizontal Position

Milling an Accurate Keyway

When milling a keyway central within .0005 in., as in gauge work, precise methods must be used. It can be done by first cutting the keyway in a piece of scrap stock to see whether the cut is the right size, and then centering in the cutter in the following manner: A surface gauge and indicator are used on both sides of the shaft, the cross slide of the milling machine being manipulated until the readings are exactly the same on both sides. As the surface-gauge rod comes in contact with the shaft, it acts as a stop.—George Shabach, Philadelphia, Pa.



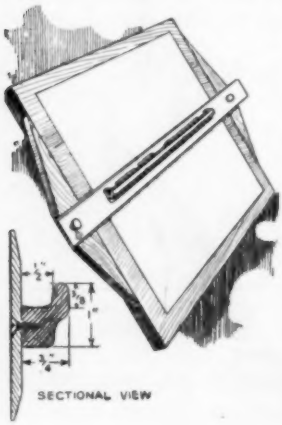
Homemade Circular Gasket Cutter Is Adjustable

Adjustable Gasket Cutter

For cutting circular gaskets, the tool shown in the drawing has been found useful. It consists of a steel center rod, equipped with a handle and ground to a point. It is drilled to receive a horizontal rod which holds a circular cutter, the latter rod being kept in position by a setscrew. A suitable handle is, of course, also provided on the horizontal rod. In use, the tool is adjusted to cut a circle of the desired diameter and while the center rod is held with the left hand, the cutter is rotated with the right.—G. L. Elwell, Amenia, N. Dak.

Ledge on the T-Square

Many draftsmen and artists who constantly use a T-square, will find the illustrated ledge for holding pencils, erasers, etc., of considerable utility. It can be made by grooving a piece of 1-in. stock of the desired length and attaching it to the T-square with small screws, taking care not to crack the wood. No matter at what angle the board is held, the groove will keep the pencils from rolling off. Of course, a similar ledge can also be provided on the lower edge of the drawing board.—August Jeffers, Bedford, Ind.



Obtaining a Smooth Finish on Soft Metals

When milling, planing, turning or otherwise machining a tough metal that has a tendency to drag and tear, such as copper, aluminum, bronze or babbitt, a smooth finish can be obtained by keeping the surface of the metal flooded with benzine, provided, of course, other factors of the workmanship are not at fault. Rough finish on these metals is usually caused by the small cuttings sticking to the surface and getting caught between the tool and the work.—H. K. Ellis, Cincinnati, Ohio.

Simple Brace for Speedy Driving of Screweyes

Bent to the shape shown, a length of steel rod makes a good speed wrench for driving in screweyes. The end is bent at right angles to the shank to insure a good hold on the screweye, and the crank section should extend far enough to afford sufficient leverage.

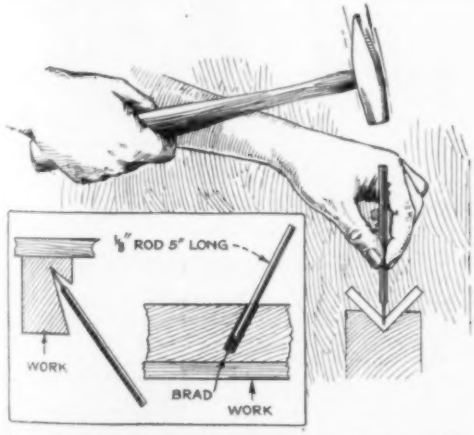
Lights of Automobile Draw Insects Away from Tent

Insects have the habit of gathering in a campers' tent during the day and then cause considerable distress to the occupants at night. A net over the opening prevents them from entering at night, but it is rather difficult to keep them out while the campers are going in and out during the daytime. A good method of eliminating the trouble is to remove all the lights from the tent as soon as it gets dark, and to turn the headlights of the car toward the tent opening. Open the net over the doorway so that the insects in the tent

can readily get out. They will be attracted by the car lights and, after a short time, every one will leave the tent. Light can then be brought into the tent again and the net kept closed.—Harold E. Benson, Denver, Colo.

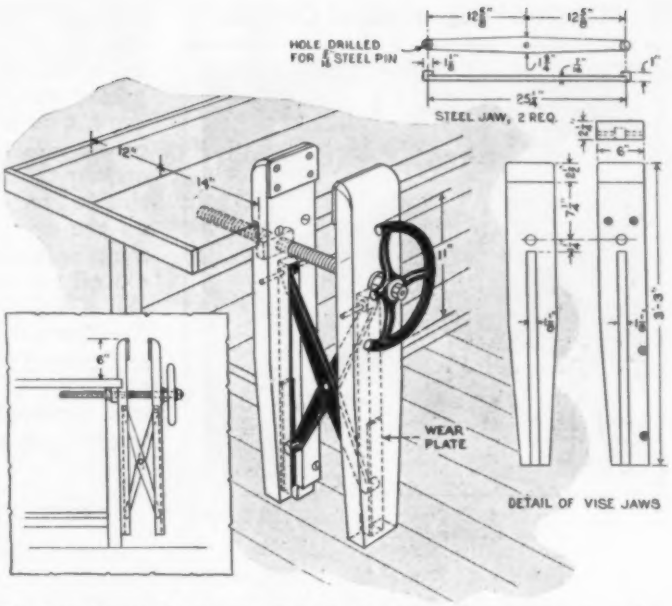
Starting Small Brads

As a scale-model builder I have often been confronted with the problem of starting small brads or tacks in places inaccessible with a hammer. It is, of course, possible to drive such brads with the aid of a nail set, but in doing so, much time is often lost owing to the difficulty of holding the brad in position until it can be started, and unfortunately a misdirected blow often has deplorable consequences. However, this trouble can readily be eliminated by using a piece of ⅛-in. drill rod, about 5 in. long, ground flat at each end and then magnetized. Such a nail set will hold the brad firmly in any desired position until it is driven in place. To magnetize the rod, stroke it from the center to one end with any magnet, or lay it across the two poles of an



Magnetized Nail Set Holds Small Brads in Position in Places Inaccessible with Hammer

electromagnet while the current is turned on.—Harold T. Bodkin, Chicago, Ill.



The Cross Braces of This Vise Hold the Jaws Parallel No Matter How Far It Is Opened

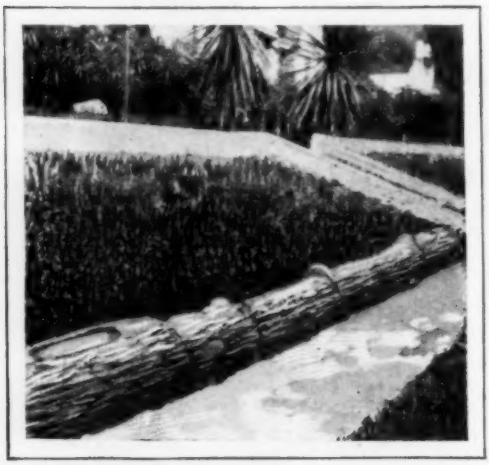
Improved Woodworkers' Vise

Keeping the jaws perfectly parallel is accomplished in the illustrated vise by means of two "lazy-tong" braces of flat iron, each pivoted at the top as indicated, while the bottom end is free to slide up and down in slots. Both crosspieces are pivoted together at the center. Hardwood is used in the construction of this vise and iron plates are fitted in the grooves to take the thrust of the lower ends of the crosspieces and avoid wear on the wood. An ordinary vise screw is used, but a cast-iron wheel has been found more useful than a handle, as the vise can be closed and opened more quickly with it. Carefully follow the construction, as illustrated, duplicating the dimensions, which are taken from a vise in actual use.

Use Old Brushes for Painting Concrete

Brushes wear out rapidly when used for painting cement and concrete. If a new brush is used, it will be found practically worthless for any other work. For this reason it is a good idea to use your old brushes on cement and concrete, thus saving new brushes for work that demands a better finish.—L. H. Georger, Buffalo, New York

"Petrified" Logs Made of Concrete



Imitation Logs Made of Concrete Finished and Painted to Resemble Real Logs

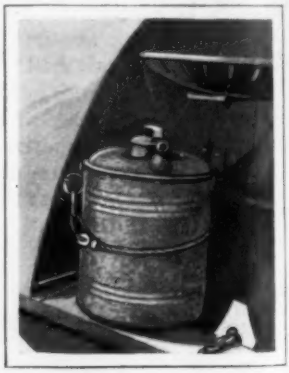
In order to prevent the earth from washing down the paths of his terraced garden, a neighbor of mine called in a Japanese cement worker to put in some curbing. The worker suggested concrete logs and the result is shown in the photo. Along the sides of the walk leading to the arbor, and at the base of the terrace, he arranged a row of stones. These he covered with a heavy coating of concrete, forming logs of various sizes. To make the imitation as realistic as possible, even the bark was simulated, scaled off in places, and the surface was then painted in wood tones and lichen shades.—Lee McCrae, Pasadena, Calif.

Lubricating Derrick Sheaves

It is almost impossible to get the average derrick operator to oil the sheaves at the top, as it is necessary to climb the mast. On an 80-ft. derrick, this difficulty was overcome by running a ¼-in. pipe along the mast, to within a few feet of the top, and fitting a length of flexible metallic hose on the end to reach the center pin of the sheave. Metallic hose comes in sizes appropriate for this purpose, together with the necessary fittings, which are a solder nipple on one end and a ¼-in. pipe-thread nipple at the other. At the bottom of the length of pipe, an elbow, taken from one of the high-pressure auto-greasing systems, was fitted. A good grade of grease, that does not harden in cold weather, was used, the entire pipe being filled by means of the high-pressure grease gun, so that, at any time afterward, a push on the gun below forced the grease into the sheave pin. This method of lubricating has also been found practicable on all clamshell buckets and on the derrick engine. In places where the nipple was likely to be broken off, the old oil cup on the bearing was removed and a solid plug was substituted for it. Another plug of the same size was drilled and tapped to take one of the grease nipples. To oil the bearing, the solid plug was removed, the one with the nipple screwed on, and the grease gun applied.

Keeping Water Can on Tractor

After I had lost two good 5-gal. water cans from the tractor platform, which was caused by their slipping off and then being run over with the plow, I decided to fasten the next can in place so that this would not happen again. A couple of harness rings were wired to the fender and a length of light rope, fitted with a snap at one end, was run around the can, one end of the rope being tied to one ring permanently, and the snap being engaged with the other ring, which permitted quick detachment.—Will E. Smith, Thief River Falls, Minn.



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